



**Manufactured for
S.W. Petroleum Services, Inc. /
PEMEX**

Cuidad Del Carmen

**Installation, Operation and
Maintenance Manual**

**Nautilus Crane Model 180B-60
Serial Number 020209C**



**CRANE SALES · PARTS · SERVICE · RENTALS
WORLDWIDE**

1180 MULBERRY RD. HOUMA, LA. 70363 U.S.A. PHONE: (985) 868-0630 FAX: (985) 873-0787

ORIGINAL

LICENSE NO. 2C-0007


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Certificate of Authority to Use Official Monogram


The AMERICAN PETROLEUM INSTITUTE hereby grants to

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Houma, Louisiana

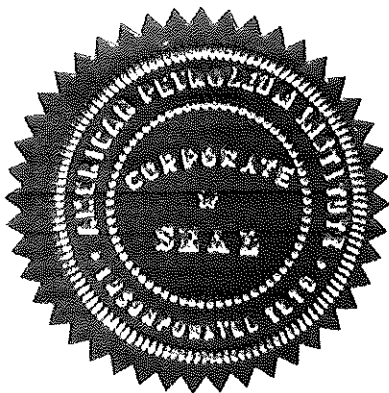
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Effective Date: **NOVEMBER 8, 2001**
Expiration Date: **NOVEMBER 8, 2004**



AMERICAN PETROLEUM INSTITUTE,

A. William Irish

Secretary

MAJOR COMPONENT LIST

Crane Model..... 180B-60
Serial Number..... 020209C

Manufacture Date June 2002

Engine N46996-005
Serial Number..... 46206550
Model Number C8.3-250

Main Hoist N46432-004
Serial Number..... 0101424

Auxiliary Hoist N46285-008
Serial Number..... 0252451

Luffing Cylinders N47035-002
Serial Number..... 4920 & 4921

Load Block..... N46831-054
Serial Number..... 0257586

Overhaul Ball N46832-001
Serial Number..... 0025139

Ballring..... N45958-001
Serial Number:..... MO-60720-10F

Swing Drive Assembly:

Motor N45686-005
Brake N47199-001
Gearbox..... N47103-002
Pinion N45853-001

TABLE OF CONTENTS

FOREWORD
INTRODUCTION
SAFETY ALERT SYMBOL
SERVICE ASSISTANCE

CRANE DESCRIPTION SECTION 1

API 2C PLACARD
CRANE GENERAL ARRANGEMENT DRAWING
 N2002SK4-036 REV. A
PEDESTAL WELDMENT DRAWING
 N2002SK1-085 REV A
POWER UNIT GENERAL ARRANGEMENT DRAWING
 N2002SK4-037 REV. A
HYDRAULIC SCHEMATIC DRAWING
 N2002SK1-087 REV. A
ELECTRIC SCHEMATIC DRAWING
 N2002SK1-089 REV. A
ELECTRIC WIRING DIAGRAM DRAWING
 N2002SK1-090 REV. A
AIR SCHEMATIC DRAWING
 N2002SK1-088 REV. A
LIFTING LOAD CAPACITY CHART
 N2002SK3-035
CRANE TEST REPORT (3 PAGES)
SERVICE ASSISTANCE

INSTALLATION SECTION 2

SERVICE ASSISTANCE
WARNING
BOLT TORQUING PROCEDURES
 BALLRING TO PEDESTAL DIAGRAM
 BALLRING TO TURRET DIAGRAM
TORQUE FOR PLATED FASTENERS CHART
RECOMMENDED ANCHORING OF WIRE ROPE
HOIST WIRE ROPE ANCHORING
WIRE ROPE BREAK-IN PROCEDURE
REEVING DIAGRAMS
 4 PART LINE
 1 PART LINE

TABLE OF CONTENTS

CRANE OPERATION SECTION 3

- SERVICE ASSISTANCE
- OPERATION GUIDELINES (3 PAGES)
- MAINTENANCE AND INSPECTION GUIDELINES
- GENERAL OPERATION OF CRANE
- OPERATION CAUTION
- CRANE OPERATION LEVER CONTROLS (2 PAGES)
- HAND SIGNAL CHART
- EMERGENCY LOAD LOWERING KIT INSTRUCTIONS (2 PAGES)
- LUFFING CYLINDER CAUTION

MAINTENANCE SECTION 4

- SERVICE ASSISTANCE
- MAINTENANCE INTRODUCTION
- MAINTENANCE PRECAUTIONS (2 PAGES)
- ROUTINE INSPECTION & SERVICE/ DAILY FUNCTIONAL TEST CHART
- NOTES AND PRECAUTIONS
- MAINTENANCE SCHEDULE CHART
 - INSPECTION/REPLACEMENT
 - LUBRICATION
- LUBRICATION DIAGRAMS
 - BALLRING DIAGRAM
 - BOOM FOOT & LUFFING CYLINDERS
 - GEARBOX DIAGRAM
 - CONTROL VALVE LINKAGE
 - LOAD BLOCK
- RECOMMENDED FLUIDS AND LUBRICANTS
 - HYDRAULIC OIL CHART
 - GEAR OIL CHART
 - GEAR OIL DIAGRAM
 - OTHER LUBRICATION POINTS LIST
 - BALLRING, PINS, BUSHINGS, SWIVELS, ENGINE, COOLANT, SWING BRAKE, HYDRAULIC ACTUATOR, HYDRAULIC LUFFING CYLINDERS, FOR PERSONNEL HANDLING, WIRE ROPE
- HOSE LIST
- ENGINE & REPLACEMENT PART LIST
- HYDRAULIC SYSTEM

TABLE OF CONTENTS

MAINTENANCE (CONT'D).....	SECTION 4
MAINTENANCE-MALFUNCTION DIAGNOSIS CHART (2 PAGES)	
MANUFACTURER'S HOIST DATA BOOKLET	
MANUFACTURER'S BALLRING DATA SHEET	
MANUFACTURER'S LOAD INDICATOR SYSTEM MANUAL	
MANUFACTURER'S ENGINE OPERATIONS AND MAINTENANCE MANUAL	
MANUFACTURER'S ELECTRIC SWIVEL OPERATIONS AND MAINTENANCE MANUAL	
 APPENDIX.....	 SECTION 5
MATERIAL CERTIFICATES	
PIN CERTIFICATES	
BALLRING CERTIFICATES	
BALLRING CLEARANCE REPORTS	
BOLT CERTIFICATES	
WIRE ROPE CERTIFICATES	
LOAD BLOCK CERTIFICATES	
OVERHAUL BALL CERTIFICATES	
BACKLASH REPORTS	
MISCELLANEOUS	

FOREWORD

Oil States Industries Houma, LA is pleased with the high quality of workmanship observed in the design, manufacture and testing of your Nautilus Crane. Maximum crane performance and utilization can be maintained only by PROPER OPERATION and equally as important, PROPER MAINTENANCE. In return, you will assure yourself a long lifespan of reliable operation and service.

Should, on the other hand, anything arise requiring service, Oil States Industries Service Department will provide you the assistance or quality maintenance you may require.

INTRODUCTION

Specifications and information in this manual are current at the time of printing. Oil States Industries reserves the right to change and/or amend these specifications at any time without notice.

This manual has been prepared to assist you in the operation and maintenance of your Nautilus Crane. However, correct and prudent operation of a crane rests with the operator who must thoroughly understand the operation of the crane and the necessary maintenance requirements. The first scheduled maintenance of your Nautilus Crane starts from day one of operation.

SAFETY ALERT SYMBOL

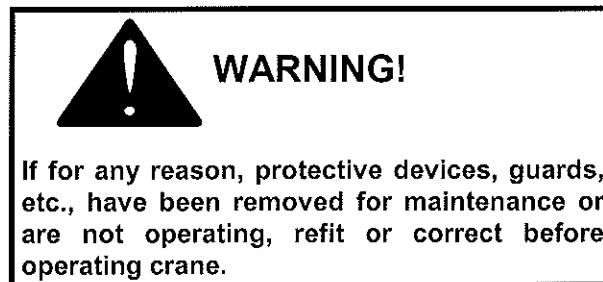
Throughout this manual, you will see this symbol.

This is the universal safety alert symbol (SAE J284A) and
“ATTENTION”.



simply means

An example is shown below:



SERVICE ASSISTANCE & ORDERING INFORMATION

24 Hours a Day

INTRODUCTION

This section contains information for ordering replacement parts for the equipment.



NOTE: CERTIFIED OEM REPLACEMENT PARTS CONTAIN NAUTILUS PART NUMBERS. INFORMATION ON PARTS NOT LISTED IN THIS MANUAL MUST BE RECEIVED FROM OSI NAUTILUS CRANE FOR PROPER VALIDATION AS NON-OEM PARTS MAY NOT MEET PERFORMANCE STANDARDS. ANY REPAIRS MADE WITH NON-OEM PARTS COULD EFFECT SAFE OPERATIONS OF THE CRANE AND CAUSE POSSIBLE PERSONNEL INJURY.

PARTS DELIVERY

To ensure prompt delivery of parts, be sure to give the correct name, address, town, state and country to which the parts are to be shipped. Include the Zip Code, if applicable, and specify the type of shipment. If the type of shipment is not specified, parts will be shipped by the best available means as determined by Oil States Industries.

PARTS AND SERVICE INQUIRIES

If difficulty is encountered with the repair of any assembly / component or if replacement parts are needed for any reason, contact the Oil States Industries Parts and Service Department for assistance at the following:

Oil States Industries
1180 Mulberry Road
Houma, LA 70363 USA

Telephone: (985) 868-0630
Toll Free: (800) 247-5530
Fax: (985) 851-0778

Oil States Industries Thailand Ltd.
450 Sukhumvit Road,
No. 102
Tambol Huaypong
Amphur Muang
Rayong 21150
Thailand

Telephone: + 66 (0) 38 691 643
Fax: + 66 (0) 38 691 644

SECTION 1
CRANE DESCRIPTION

API SPEC 2C

FIFTH EDITION 1995



2C-0007

DATE MANUFACTURED

JUNE 2002

MANUFACTURER'S MODEL NO.

180B-60

DESIGN SERVICE TEMPERATURE

+32

DEG. F.

MANUFACTURER SERIAL NUMBER

020209C

MANUFAC-
TURED BY

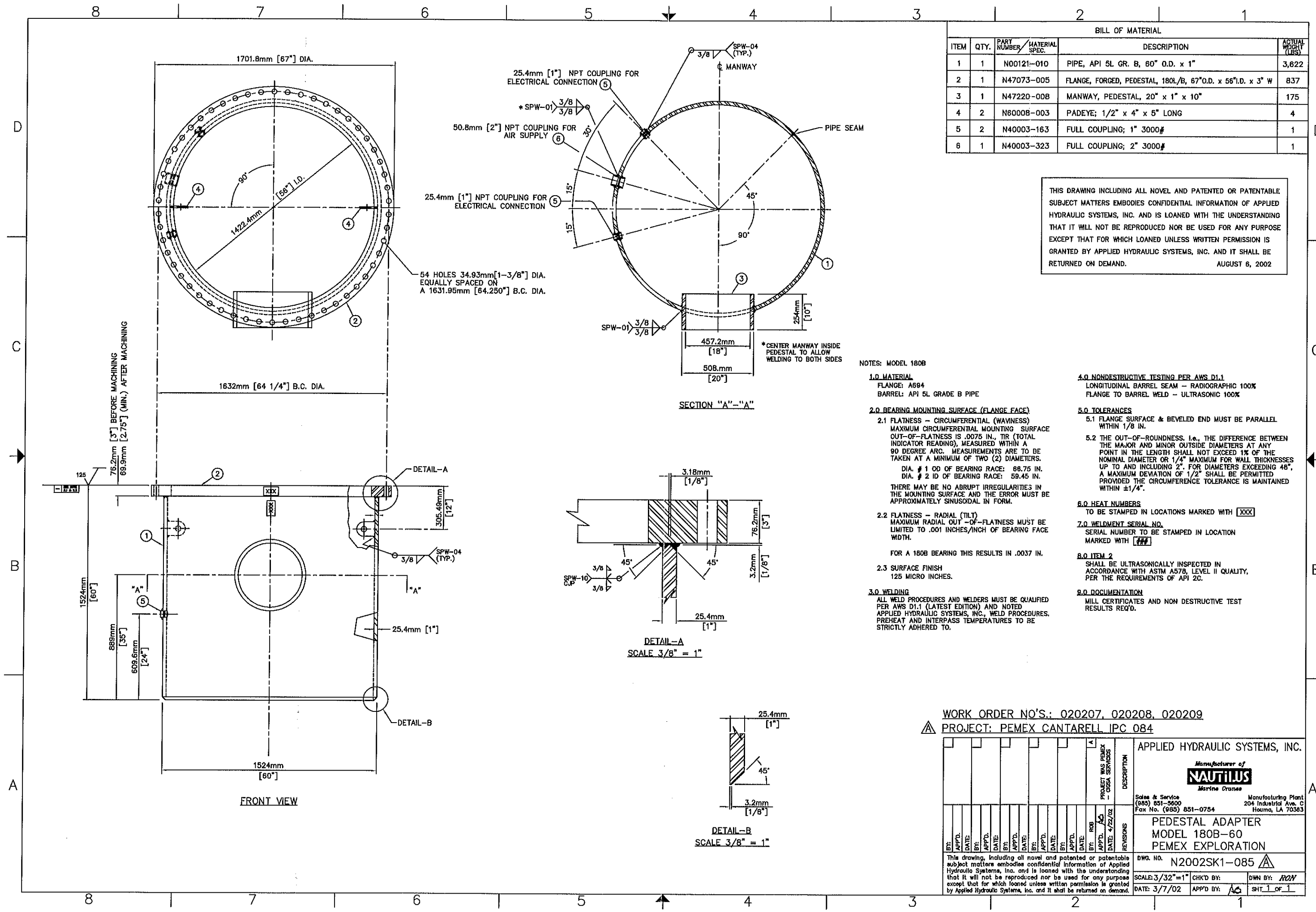
APPLIED HYDRAULIC SYSTEMS, INC
NAUTILUS MARINE CRANES

ADDRESS

HOUMA, LOUISIANA 70363

CRANE GENERAL ARRANGEMENT DRAWING

PEDESTAL WELDMENT DRAWING



BILL OF MATERIAL				
ITEM	QTY.	PART NUMBER	MATERIAL SPEC.	DESCRIPTION
1	1	N00121-010		PIPE, API 5L GR. B, 60" O.D. x 1"
2	1	N47073-005		FLANGE, FORGED, PEDESTAL, 180L/B, 67"O.D. x 56" I.D. x 3" W
3	1	N47220-008		MANWAY, PEDESTAL, 20" x 1" x 10"
4	2	N60008-003		PADEYE; 1/2" x 4" x 5" LONG
5	2	N40003-163		FULL COUPLING; 1" 3000#
6	1	N40003-323		FULL COUPLING; 2" 3000#

THIS DRAWING INCLUDING ALL NOVEL AND PATENTED OR PATENTABLE SUBJECT MATTERS EMBODIES CONFIDENTIAL INFORMATION OF APPLIED HYDRAULIC SYSTEMS, INC. AND IS LOANED WITH THE UNDERSTANDING THAT IT WILL NOT BE REPRODUCED NOR BE USED FOR ANY PURPOSE EXCEPT THAT FOR WHICH LOANED UNLESS WRITTEN PERMISSION IS GRANTED BY APPLIED HYDRAULIC SYSTEMS, INC. AND IT SHALL BE RETURNED ON DEMAND.

AUGUST 6, 2002

NOTES: MODEL 180B

- 1.0 MATERIAL**
FLANGE: A684
BARREL: API 5L GRADE B PIPE
- 2.0 BEARING MOUNTING SURFACE (FLANGE FACE)**
2.1 FLATNESS - CIRCUMFERENTIAL (WAVINESS)
MAXIMUM CIRCUMFERENTIAL MOUNTING SURFACE OUT-OF-FLATNESS IS .0075 IN., TIR (TOTAL INDICATOR READING), MEASURED WITHIN A 90 DEGREE ARC. MEASUREMENTS ARE TO BE TAKEN AT A MINIMUM OF TWO (2) DIAMETERS.
DIA. # 1 O.D. OF BEARING RACE: 88.75 IN.
DIA. # 2 I.D. OF BEARING RACE: 59.45 IN.
THERE MAY BE NO ABRUPT IRREGULARITIES IN THE MOUNTING SURFACE AND THE ERROR MUST BE APPROXIMATELY SINUSOIDAL IN FORM.
- 2.2 FLATNESS - RADIAL (TILT)
MAXIMUM RADIAL OUT-OF-FLATNESS MUST BE LIMITED TO .001 INCHES/INCH OF BEARING FACE WIDTH.
- FOR A 180B BEARING THIS RESULTS IN .0037 IN.
- 2.3 SURFACE FINISH
125 MICRO INCHES.
- 3.0 WELDING**
ALL WELD PROCEDURES AND WELDERS MUST BE QUALIFIED PER AWS D1.1 (LATEST EDITION) AND NOTED APPLIED HYDRAULIC SYSTEMS, INC., WELD PROCEDURES. PREHEAT AND INTERPASS TEMPERATURES TO BE STRICTLY ADHERED TO.

- 4.0 NONDESTRUCTIVE TESTING PER AWS D1.1**
LONGITUDINAL BARREL SEAM - RADIOGRAPHIC 100%
FLANGE TO BARREL WELD - ULTRASONIC 100%
- 5.0 TOLERANCES**
5.1 FLANGE SURFACE & BEVELED END MUST BE PARALLEL WITHIN 1/8 IN.
5.2 THE OUT-OF-ROUNDNESS, I.E., THE DIFFERENCE BETWEEN THE MAJOR AND MINOR OUTSIDE DIAMETERS AT ANY POINT IN THE LENGTH SHALL NOT EXCEED 1% OF THE NOMINAL DIAMETER OR 1/4" MAXIMUM FOR WALL THICKNESSES UP TO AND INCLUDING 2". FOR DIAMETERS EXCEEDING 48", A MAXIMUM DEVIATION OF 1/2" SHALL BE PERMITTED PROVIDED THE CIRCUMFERENCE TOLERANCE IS MAINTAINED WITHIN ±1/4".
- 6.0 HEAT NUMBERS**
TO BE STAMPED IN LOCATIONS MARKED WITH [XXX]
- 7.0 WELDMENT SERIAL NO.**
SERIAL NUMBER TO BE STAMPED IN LOCATION MARKED WITH [###]
- 8.0 ITEM 2**
SHALL BE ULTRASONICALLY INSPECTED IN ACCORDANCE WITH ASTM A578, LEVEL II QUALITY, PER THE REQUIREMENTS OF API 20.
- 9.0 DOCUMENTATION**
WILL CERTIFICATES AND NON DESTRUCTIVE TEST RESULTS REQ'D.

WORK ORDER NO'S.: 020207, 020208, 020209
PROJECT: PEMEX CANTARELL IPC 084

APPLIED HYDRAULIC SYSTEMS, INC.									
<div>Manufacturer of NAUTILUS Marine Cranes</div>									
Sales & Service (985) 351-3600 Fax No. (985) 851-0754					Manufacturing Plant 204 Industrial Ave. C Houma, LA 70363				
PEDESTAL ADAPTER MODEL 180B-60 PEMEX EXPLORATION									
DWG. NO. N2002SK1-085									
SCALE: 3/32"=1" CHK'D BY: DWN BY: R20V									
DATE: 3/7/02 APP'D BY: AG SH: 1 OF 1									

REVISIONS

NO.	DATE	BY	DESCRIPTION
1	4/22/02	AG	PROJECT WAS PERFORMED BY CUSA SERVICES

THIS DRAWING, INCLUDING ALL NOVEL AND PATENTED OR PATENTABLE SUBJECT MATTERS EMBODIES CONFIDENTIAL INFORMATION OF APPLIED HYDRAULIC SYSTEMS, INC. AND IS LOANED WITH THE UNDERSTANDING THAT IT WILL NOT BE REPRODUCED NOR BE USED FOR ANY PURPOSE EXCEPT THAT FOR WHICH LOANED UNLESS WRITTEN PERMISSION IS GRANTED BY APPLIED HYDRAULIC SYSTEMS, INC. AND IT SHALL BE RETURNED ON DEMAND.

**POWER UNIT GENERAL
ARRANGEMENT DRAWING**

8 7 6 5 4 3 2 1

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AUGUST 6, 2002

NOTE:

1. ENGINE EQUIPPED WITH AN AIR START SYSTEM.
2. ENTIRE POWER UNIT IS SURROUNDED BY DRIP PAN.
3. ENGINE EQUIPPED WITH A MANUAL EMERGENCY AIR INTAKE SHUTDOWN SYSTEM.
4. ENGINE GAUGE AND CONTROL PANEL IS LOCATED IN THE OPERATORS CAB.
5. HYDRAULIC RESERVOIR AND FUEL TANK TO BE SHIPPED FULL.
6. HIGH WATER TEMPERATURE, LOW OIL PRESSURE, AND OVERSPEED AUTOMATIC SHUTDOWN SYSTEM.
7. HOOD AND SIDE PANELS PROVIDED BUT NOT SHOWN FOR CLARITY.

D

C

B

A

10 MICRON RETURN FILTER

HYDRAULIC OIL LEVEL GAUGE

HYDRAULIC OIL FILLER BREATHER

ALL SERVICE POINTS THIS SIDE OF ENGINE
- DIPSTICK
- FUEL FILTER
- OIL FILTER
- STARTER
- GOVERNOR

FUEL LEVEL GAUGE

DIESEL FUEL FILLER BREATHER

BLANKET WRAP EXHAUST INSULATION

STAINLESS STEEL FLEX CONNECTION

LIFTING EYES

TUBULAR (3"x3"x1/4") SEAL WELDED LIFTING BAIL

EPOXY COATED RADIATOR

FOUR SECTION HYDRAULIC GEAR PUMP

18" BOLTED ACCESS COVER W/GASKET (2)

350 GALLON HYD. RESERVOIR

DIESEL FUEL

HYD. OIL

175 GALLON FUEL TANK

76.20mm [3"] DRIP PAN

177.80mm [7"]

50.8mm [2"] NPT SPILL CONTAINMENT DRAIN COLLAR

1473.20mm [68"]
DRAINS W/ PLUGGED BALL VALVES

2438.40mm [98"]

SERIAL NO'S.: 020207, 020208, 020209
PROJECT: PEMEX CANTARELL IPC 084

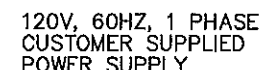
APPLIED HYDRAULIC SYSTEMS, INC.									
<div>Manufacturer of NAUTILUS Marine Cranes</div> <div>Sales & Service (985) 851-5800 Fax No. (985) 851-0754</div> <div>Manufacturing Plant 204 Industrial Ave. C Houma, LA 70363</div>									
GENERAL ARRANGEMENT CUMMINS 6CTA8.3 PEMEX EXPLORATION									
DWG. NO. N 2002SK4-037									
SCALE: 1"=1'-0" CHK'D BY: DWN BY: AGY									
DATE: 3/7/02 APP'D BY: AGY SHT. 1 OF 1									

8 7 6 5 4 3 2 1

HYDRAULIC SCHEMATIC DRAWING

ELECTRICAL SCHEMATIC DRAWING

AUGUST 6, 2002



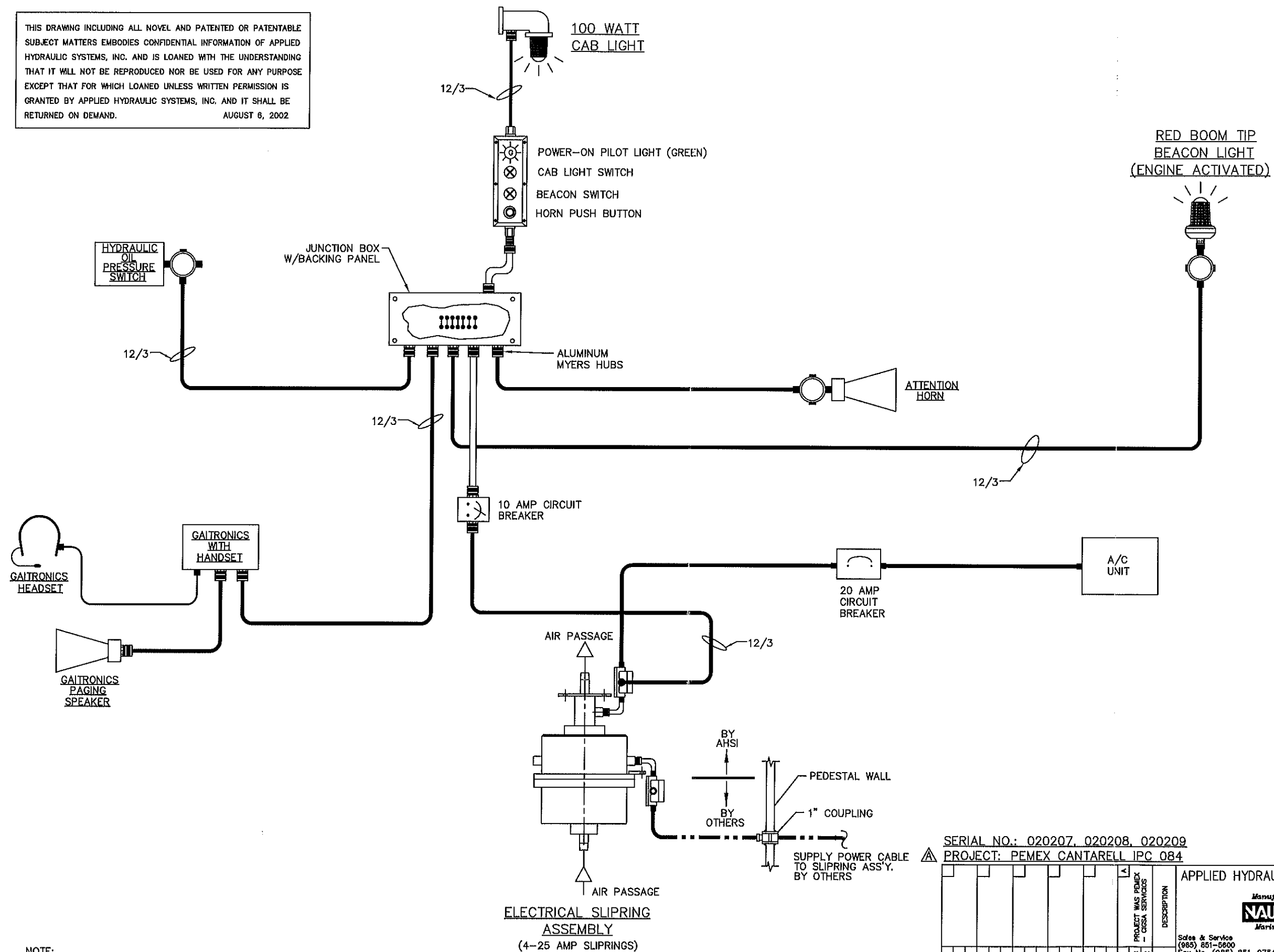
SERIAL NO.: 020207, 020208, 020209
 A PROJECT: PEMEX CANTARELL IPC 084

[illegible]

ELECTRICAL DIAGRAM DRAWING

THIS DRAWING INCLUDING ALL NOVEL AND PATENTED OR PATENTABLE SUBJECT MATTERS EMBODIES CONFIDENTIAL INFORMATION OF APPLIED HYDRAULIC SYSTEMS, INC. AND IS LOANED WITH THE UNDERSTANDING THAT IT WILL NOT BE REPRODUCED NOR BE USED FOR ANY PURPOSE EXCEPT THAT FOR WHICH LOANED UNLESS WRITTEN PERMISSION IS GRANTED BY APPLIED HYDRAULIC SYSTEMS, INC. AND IT SHALL BE RETURNED ON DEMAND.

AUGUST 6, 2002



- NOTE:
1. ALL ELECTRICAL ITEMS ARE MARINE DUTY.
 2. 120 V, 60 HZ, 1 PHASE SYSTEM REQUIRED POWER SUPPLY.
 3. ALL CABLE IS ARMORED SHIPBOARD CABLE WITH PVC JACKET.

SERIAL NO.: 020207, 020208, 020209
PROJECT: PEMEX CANTARELL IPC 084

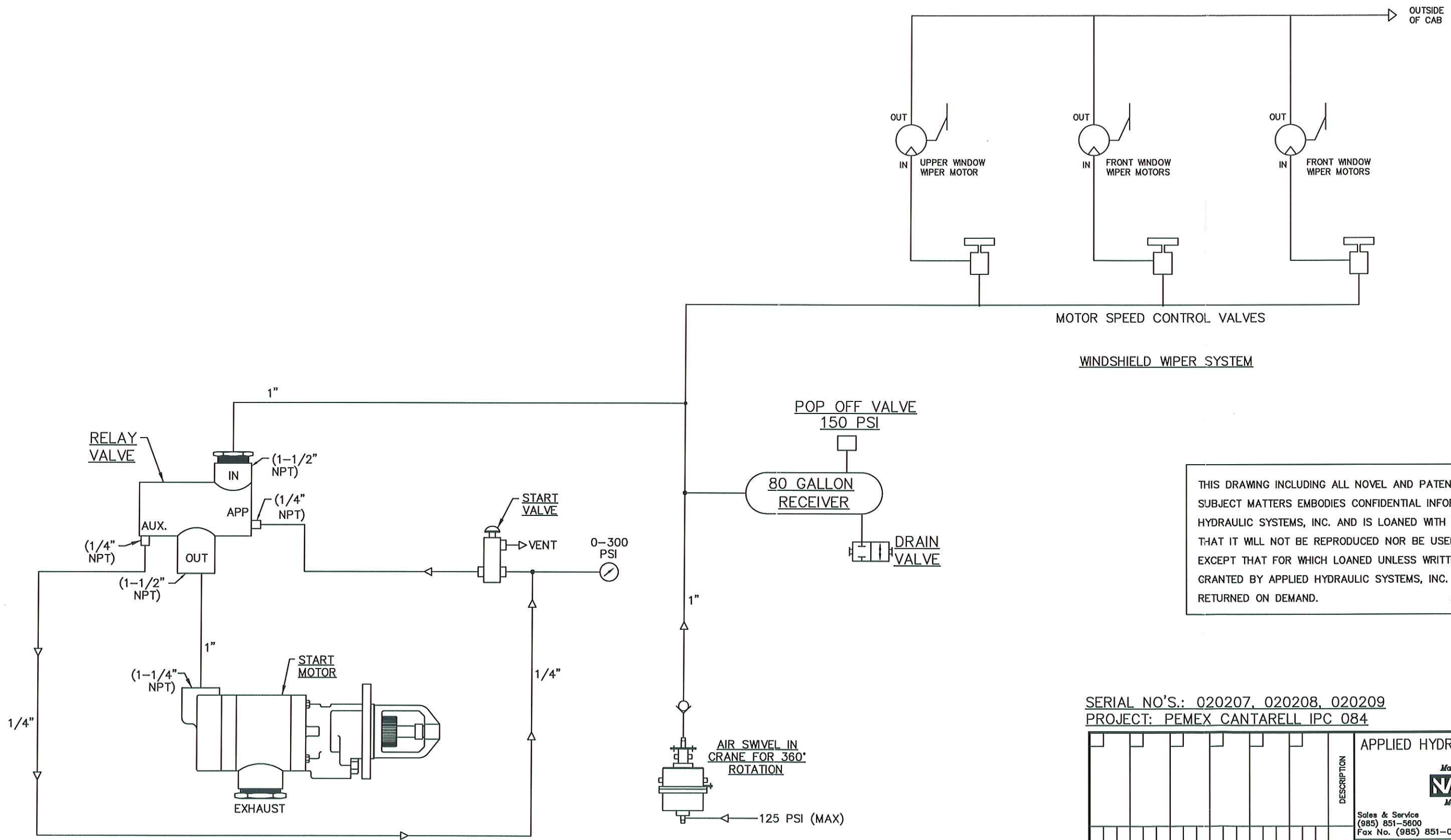
BY:	DATE:	DESCRIPTION:
BY: ROB	DATE: 4/22/02	PROJECT WAS PEMEX CISA SERVICES
BY: AG	DATE: 4/22/02	REVISIONS

APPLIED HYDRAULIC SYSTEMS, INC.
Manufacturer of **NAUTILUS** Marine Cranes
Sales & Service (985) 851-5600
Fax No. (985) 851-0754
Manufacturing Plant 204 Industrial Ave. C Houma, LA 70363

WIRING DIAGRAM
MODEL 180B-60
PEMEX EXPLORATION

DWG. NO. N2002SK1-090
SCALE: NONE
DATE: 3/11/02
APP'D BY: AG
SHT 1 OF 1

AIR SCHEMATIC DRAWING



THIS DRAWING INCLUDING ALL NOVEL AND PATENTED OR PATENTABLE SUBJECT MATTERS EMBODIES CONFIDENTIAL INFORMATION OF APPLIED HYDRAULIC SYSTEMS, INC. AND IS LOANED WITH THE UNDERSTANDING THAT IT WILL NOT BE REPRODUCED NOR BE USED FOR ANY PURPOSE EXCEPT THAT FOR WHICH LOANED UNLESS WRITTEN PERMISSION IS GRANTED BY APPLIED HYDRAULIC SYSTEMS, INC. AND IT SHALL BE RETURNED ON DEMAND.

AUGUST 6, 2002

SERIAL NO'S.: 020207, 020208, 020209
PROJECT: PEMEX CANTARELL IPC 084

												APPLIED HYDRAULIC SYSTEMS, INC. Manufacturer of NAUTILUS Marine Cranes Sales & Service (985) 851-5600 Fax No. (985) 851-0754 Manufacturing Plant 204 Industrial Ave. C Houma, LA 70363	
												AIR SCHEMATIC MODEL 180B-60 PEMEX EXPLORATION	
DWG. NO. M2002SK1-088 SCALE: NONE DATE: 3/11/02												DWN BY: RDN APP'D BY: [Signature] SHT. 1 OF 1	

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LOAD CHART

APPLIED HYDRAULIC SYSTEMS, INC.
204 INDUSTRIAL AVENUE C
HOUMA, LOUISIANA 70363
(985) 851-5600

NAUTILUS
MARINE CRANES



NET LIFTING LOAD CAPACITY **NAUTILUS MODEL 180B-60 MARINE CRANE**

		MAIN HOIST		AUXILIARY HOIST		
		FOUR PART REEVING		SINGLE PART REEVING		
RADIUS (FT)	BOOM ANGLE (DEG)	STATIC (LBS)	DYNAMIC (LBS)	STATIC (LBS)	DYNAMIC (LBS)	PERSONNEL (LBS)
10	81	33,040	33,040	4,318	4,318	1,263
15	76	33,040	33,040			
20	72	33,040	33,040			
25	67	33,040	33,040			
30	61	33,040	33,040			
35	56	33,040	28,760			
40	50	33,040	24,852			
45	43	33,040	21,837			
50	35	29,478	19,439			
55	25	26,548	17,485			
60	0	21,096	13,851			

- NOTE:
- ABOVE MAIN HOIST LIFTING CAPACITIES ARE BASED ON (4) FOUR PART REEVING OF 5/8" DIAMETER SUPER FLEX PAC 19 WIRE ROPE . (BREAKING STRENGTH = 45,400 LBS.) 930 FT. OF WIRE ROPE IS REQUIRED.
 - ABOVE AUXILIARY HOIST LIFTING CAPACITIES ARE BASED ON SINGLE PART REEVING OF 1/2" DIAMETER SUPER FLEX PAC 19 WIRE ROPE . (BREAKING STRENGTH = 29,200 LBS.) 297 FT. OF WIRE ROPE IS REQUIRED.
 - ALL RATINGS IN ACCORDANCE WITH API SPECIFICATION 2C (SPEC 2C), FIFTH EDITION, APRIL 3, 1995.
 - A DYNAMIC COEFFICIENT (Cb) OF 2.0 IS USED.
 - SHEAVE EFFICIENCY IS CONSIDERED.
 - THE ABOVE RATINGS ARE NET RATINGS AS THE MAIN LOAD BLOCK WEIGHT OF 640 LBS. AND THE AUXILIARY LOAD BLOCK WEIGHT OF 210 LBS. HAVE BEEN SUBTRACTED TO DETERMINE "NET" CAPACITY.

Crane Acceptance Test Procedure and Report



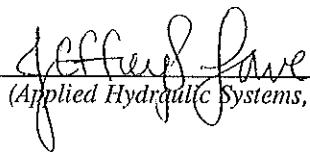
Nautilus Model 180B-60 Marine Crane

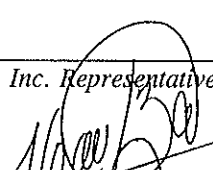
for


**S.W. Petroleum Services, Inc./Pemex
Pemex Cantarell IPC 084**

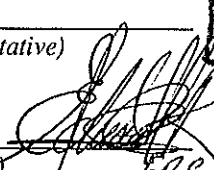
Serial Number: 020209C

June 17, 2002


(Applied Hydraulic Systems, Inc. Representative)


(S.W. Petroleum Services, Inc. Representative)


(Cigsa Construcción S.A. de C.V. Representative)


(Pemex Representative (Witness Only))



SECTION 1 - Gauges:

Accept	Not Accept	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Hydraulic Pressure (Main Hoist)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Hydraulic Pressure (Aux. Hoist)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Hydraulic Pressure (Boom)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Hydraulic Pressure (Swing)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Hydraulic Pressure (Return)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Engine Oil Pressure
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Engine Water Temperature <u>180°</u> F
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Hydraulic Oil Temperature <u>150°</u> F
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Engine Tachometer
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Engine Hourmeter
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Hydraulic Oil Level
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Diesel Fuel Level
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Load Cell (Main)

SECTION 2 - Function Test the Following:

Accept	Not Accept	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Engine Start (Air)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Engine Throttle
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Engine Air Intake Shutdown
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Engine Shutdown (Fuel)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Main Line Anti-Two Block
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Auxiliary Line Anti-Two Block
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Swing Park Brake
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Anti-Two Block Override (Main & Aux)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Free Swing Capability
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Dynamic Swing Brake
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Air Windshield Wipers
<input checked="" type="checkbox"/>	<input type="checkbox"/>	360° Continuous Rotation

SECTION 3 - Electrical:

Accept	Not Accept	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Air Conditioner
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Boom Tip Beacon
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Gaitronics Load Speaker System
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Cab Light
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Power On Light (Green)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Circuit Breaker
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Attention Horn

SECTION 4 - Sound Level Readings:

<u>92</u>	dB(A) (Idle)	
<u>90.8</u>	dB(A) (Loaded)	Cab Door & Window Closed

SECTION 5 - Performance Speeds:

SWING SPEEDS:

Clockwise 360°	<u>46</u>	Sec.
Counter-Clockwise 360°	<u>46.7</u>	Sec.

BOOM SPEED:

0° to Maximum Angle	<u>60</u>	Sec.
---------------------	-----------	------

ENGINE RPM

Idle	<u>1,436</u>	rpm
Full Throttle	<u>2,683</u>	rpm

SECTION 6 - Baseline Pressure Readings with no Load:

FUNCTION	BOOM ANGLE (Degrees)	CRACKING PRESSURE NO LOAD (PSI)	FULL SPEED PRESSURE NO LOAD (PSI)
Boom Up:	60	600	500
Boom Down:	60	500	1,600
Main Hoist Up:	60	300	600
Main Hoist Down:	60	900	1,400
Aux. Hoist Up:	60	400	700
Aux. Hoist Down:	60	500	1,400
Swing CW:	60	100	600
Swing CCW:	60	0	600

gch
BVI

SECTION 7 - Load Test:

Main Hoist: 4-Part Reeving

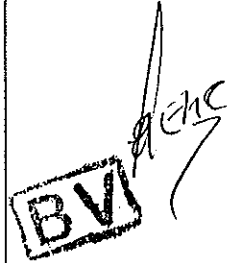
Test No.	Radius (ft.)	Static Rated Load (Lbs.)	Test Load (Lbs.)	Percent of Rated Load	Cracking Pressure Hoist (PSI)		Full Speed Pressure Main (PSI)		Swing Pressure (PSI)		Boom Pressure (PSI)		Load Cell (Lbs.)	Hook Speed (FPM)
					Up	Down	Up	Down	CCW	CW	Up	Down		
1	20	33,040	33,030	100%	2,000	600	2,300	1,200	250	0	1,200	800	33,070	64
2	45	33,040	33,030	100%	2,000	700	2,300	1,200	500	0	22,00	600	33,070	

Auxiliary Hoist: 1-Part Reeving

Test No.	Radius (ft.)	Static Rated Load (Lbs.)	Test Load (Lbs.)	Percent of Rated Load	Cracking Pressure Aux. (PSI)		Full Speed Pressure Aux. (PSI)		Swing Pressure (PSI)		Boom Pressure (PSI)		Hook Speed (FPM)
					Up	Down	Up	Down	CCW	CW	UP	Down	
3	35	4,318	4,270	98.9%	2,200	500	2,700	1,200	200	200	800	900	370

TEST WEIGHTS (Lbs.)

1	SLG	+	A	+	F	+	I	+	7 rd wts	
	100	+	2,360	+	1,330	+	26,510	+	2,730	= 33,030
2	SLG	+	A	+	F	+	I	+	7 rd wts	
	100	+	2,360	+	1,330	+	26,510	+	2,730	= 33,030
3	SLG	+	3" pl	+	3 rd wts					
	100	+	3,000	+	1,170	=	4,270			



SECTION 7 - Load Test:

Main Hoist: 4-Part Reeving

Test No.	Radius (Ft.)	Static Rated Load (Lbs.)	Test Load (Lbs.)	Percent of Rated Load	Cracking Pressure Hoist (PSI)		Full Speed Pressure Main (PSI)		Swing Pressure (PSI)		Boom Pressure (PSI)		Load Cell (Lbs.)	Hook Speed (FPM)
					Up	Down	Up	Down	CCW	CW	Up	Down		
1	20	33,040	33,030	100%	1,000	500	2,200	1,300	100	0	1,200	800	33,500	69.8
2	45	33,040	33,030	100%	900	700	2,200	1,300	100	0	2,200	1,600	33,500	

Auxiliary Hoist: 1-Part Reeving

Test No.	Radius (Ft.)	Static Rated Load (Lbs.)	Test Load (Lbs.)	Percent of Rated Load	Cracking Pressure Aux. (PSI)		Full Speed Pressure Aux. (PSI)		Swing Pressure (PSI)		Boom Pressure (PSI)		Hook Speed (FPM)
					Up	Down	Up	Down	CCW	CW	UP	Down	
3	35	4,318	4,270	98.9%	2,300	400	2,600	1,200	100	0	600	1,000	375

TEST WEIGHTS (Lbs.)

1	SLG	+	A	+	F	+	I	+	7 rd wts	
	100	+	2,360	+	1,330	+	26,510	+	2,730	= 33,030
2	SLG	+	A	+	F	+	I	+	7 rd wts	
	100	+	2,360	+	1,330	+	26,510	+	2,730	= 33,030
3	SLG	+	3" pl	+	3 rd wts					
	100	+	3,000	+	1,170	=	4,270			



SERVICE ASSISTANCE & ORDERING INFORMATION

24 Hours a Day

INTRODUCTION

This section contains information for ordering replacement parts for the equipment.



NOTE: CERTIFIED OEM REPLACEMENT PARTS CONTAIN NAUTILUS PART NUMBERS. INFORMATION ON PARTS NOT LISTED IN THIS MANUAL MUST BE RECEIVED FROM OSI NAUTILUS CRANE FOR PROPER VALIDATION AS NON-OEM PARTS MAY NOT MEET PERFORMANCE STANDARDS. ANY REPAIRS MADE WITH NON-OEM PARTS COULD EFFECT SAFE OPERATIONS OF THE CRANE AND CAUSE POSSIBLE PERSONNEL INJURY.

PARTS DELIVERY

To ensure prompt delivery of parts, be sure to give the correct name, address, town, state and country to which the parts are to be shipped. Include the Zip Code, if applicable, and specify the type of shipment. If the type of shipment is not specified, parts will be shipped by the best available means as determined by Oil States Industries.

PARTS AND SERVICE INQUIRIES

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1180 Mulberry Road
Houma, LA 70363 USA

Telephone: (985) 868-0630
Toll Free: (800) 247-5530
Fax: (985) 851-0778

Oil States Industries Thailand Ltd.
450 Sukhumvit Road,
No. 102
Tambol Huaypong
Amphur Muang
Rayong 21150
Thailand

Telephone: + 66 (0) 38 691 643
Fax: + 66 (0) 38 691 644

SECTION 2 INSTALLATION

SERVICE ASSISTANCE & ORDERING INFORMATION

24 Hours a Day

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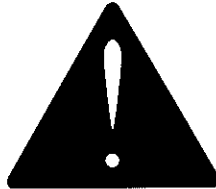
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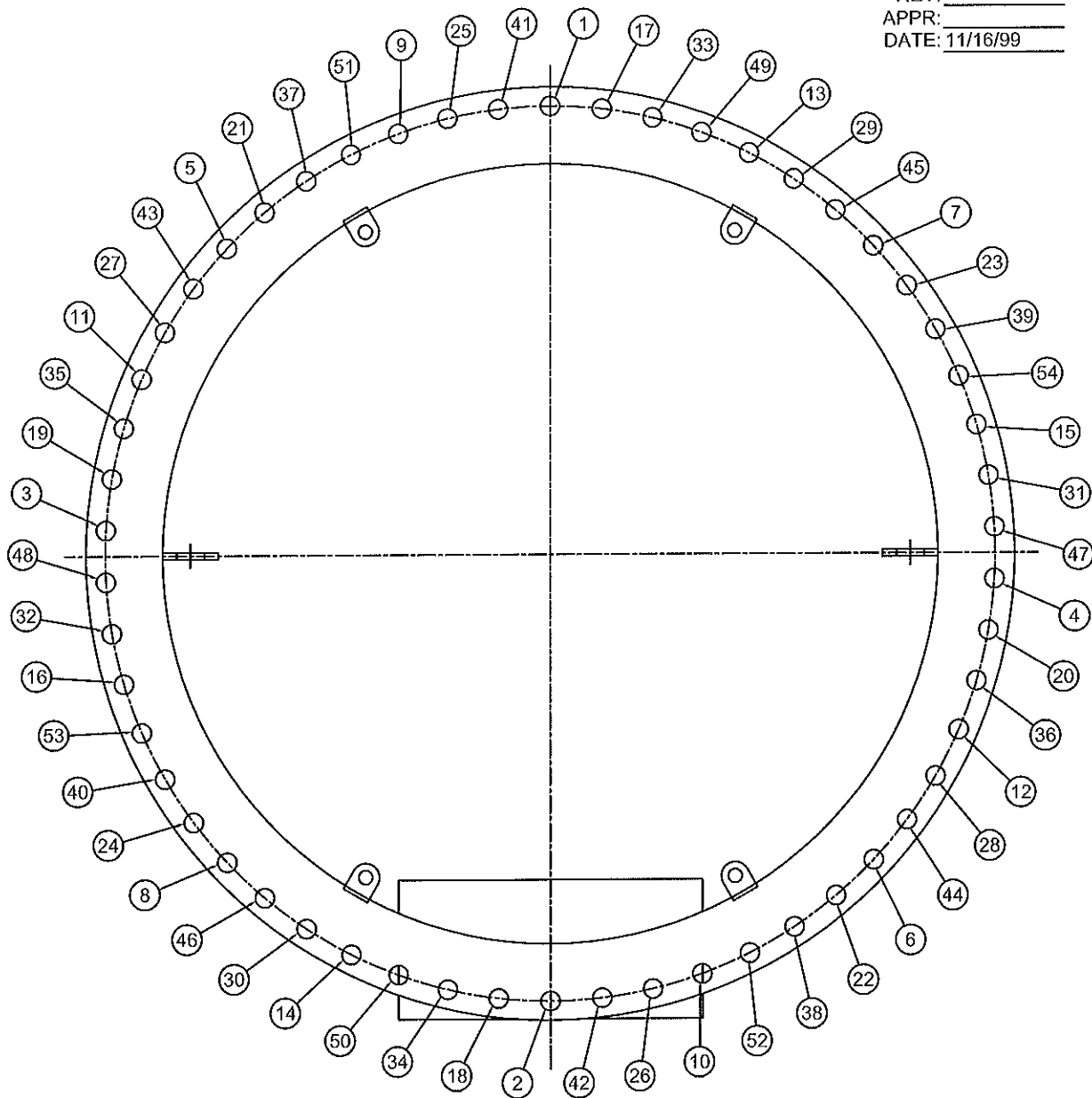
Telephone: + 66 (0) 38 691 643
Fax: + 66 (0) 38 691 644

WARNING



FAILURE TO USE PROPER BALLRING FASTENERS
COULD RESULT IN PROPERTY DAMAGE, SEVERE
PERSONAL INJURY, OR DEATH.

REPLACEMENT FASTENERS MUST MEET THE
SPECIFIC REQUIREMENTS OF API SPECIFICATION
2C, SECTION 13.5, FIFTH EDITION.

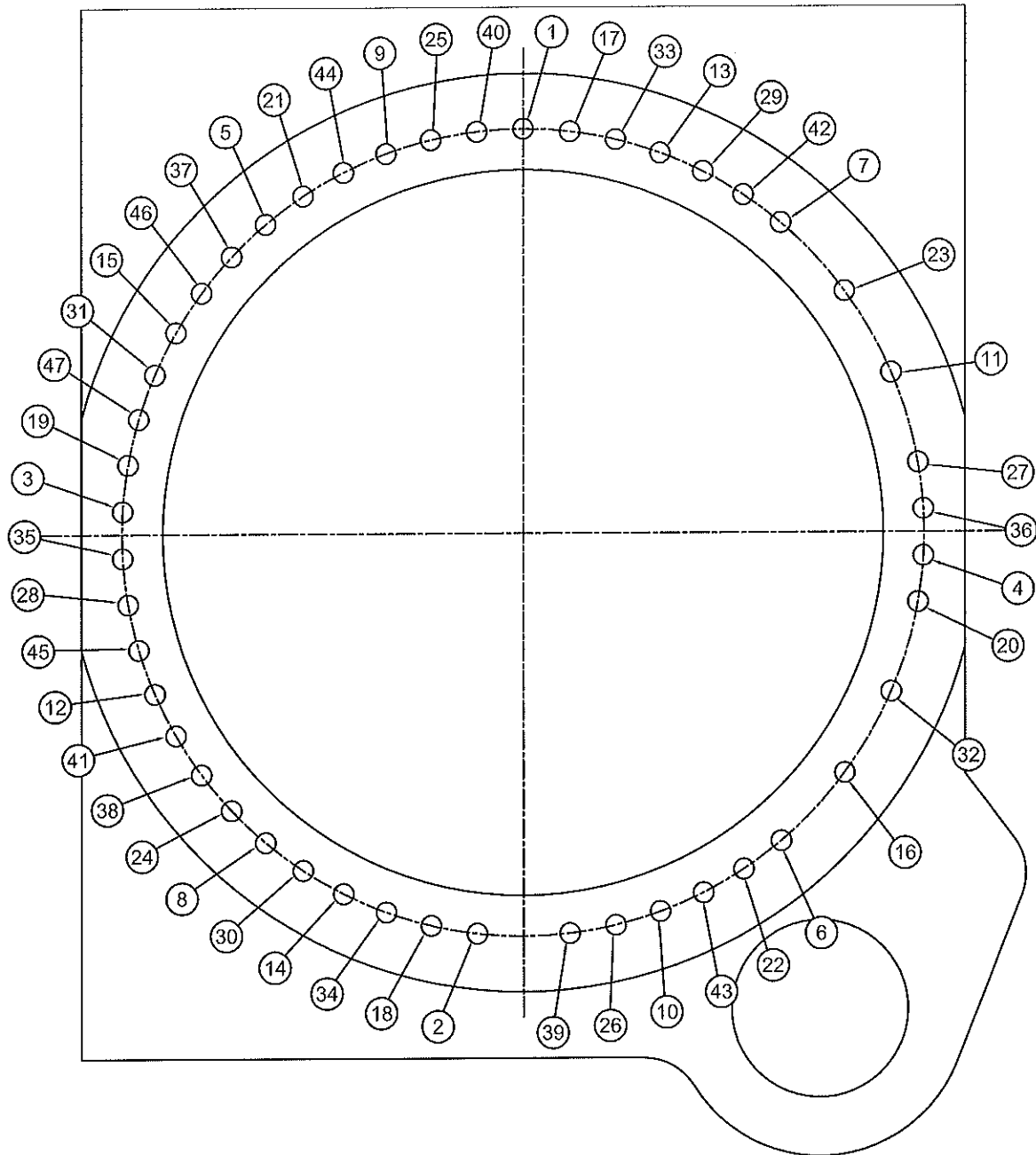


*NOTE: USE 1-1/4" - 7UNC x 4-1/2" LONG
 GRADE 8 BOLTS MEETING
 API 2C REQUIREMENTS

BOLT TORQUING PROCEDURE

BALLRING TO PEDESTAL

1. Do not use oil or grease (Hydraulic oil only).
2. Diagram shows the sequence bolts are to be tightened.
3. Bolts are to be torqued in increments of 50, 80 and 100% of the maximum torque value of 1,236 ft-lbs.
 - a.) First iteration torque to 618 ft-lbs.
 - b.) Second iteration torque to 989 ft-lbs.
 - c.) Final iteration torque to 1,236 ft-lbs.



*NOTE: USE 1-1/4" - 7UNC x 4-1/2" LONG
GRADE 8 BOLTS MEETING
API 2C REQUIREMENTS

BOLT TORQUING PROCEDURE **BALLRING TO UPPERSTRUCTURE**

1. Do not use oil or grease (Hydraulic oil only).
2. Diagram shows the sequence bolts are to be tightened.
3. Bolts are to be torqued in increments of 50, 80 and 100% of the maximum torque value of 1,236 ft-lbs.
 - a.) First iteration torque to 618 ft-lbs.
 - b.) Second iteration torque to 989 ft-lbs.
 - c.) Final iteration torque to 1,236 ft-lbs.

TORQUE FOR PLATED FASTENERS



DO NOT APPLY TO CRANE MOUNTING BEARING.

- Threads must be free of debris, damage, and coated with hydraulic oil or a light machine oil. The torque values are not valid for threads with grease or anti-seizing compound.

GRADE 8			
NOMINAL BOLT SIZE (IN)	MINIMUM (FT/LBS)	MID-RANGE (FT/LBS)	MAXIMUM (FT/LBS)
3/8 - 16	33	35	37
1/2 - 13	76	80	84
9/16 - 12	104	110	115
5/8 - 11	161	170	178
3/4 - 10	266	280	294
7/8 - 9	437	460	483
1 - 8	646	680	714
1-1/4 - 7	1,292	1,360	1,428
1-3/8 - 6	1,691	1,780	1,869
1-1/2 - 6	2,242	2,360	2,478

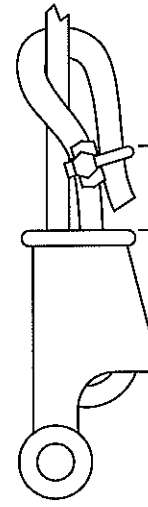
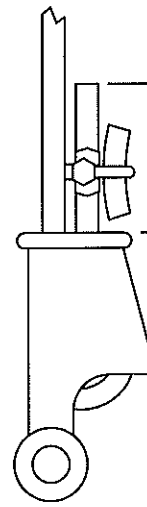
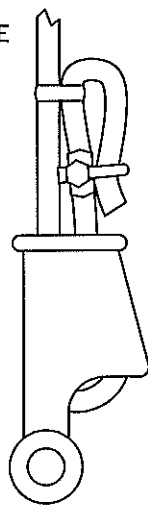
GRADE 5			
NOMINAL BOLT SIZE (IN)	MINIMUM (FT/LBS)	MID-RANGE (FT/LBS)	MAXIMUM (FT/LBS)
3/8 - 16	21	23	24
1/2 - 13	62	65	68
9/16 - 12	76	80	84
5/8 - 11	104	110	115
3/4 - 10	190	200	210
7/8 - 9	285	300	315
1 - 8	418	440	462
1-1/4 - 7	798	840	882
1-3/8 - 6	1,045	1,100	1,155
1-1/2 - 6	1,367	1,460	1,533

FASTENER MARKINGS		
	GRADE 5	GRADE 8
BOLT SAE J429		
NUT SAE J995	OR	OR

RECOMMENDED ANCHORING OF WIRE ROPE AT DEAD END

DEAD END — WEDGE SOCKET

SERVE LOOP TO LOAD
LINE LOOSELY WITH WIRE



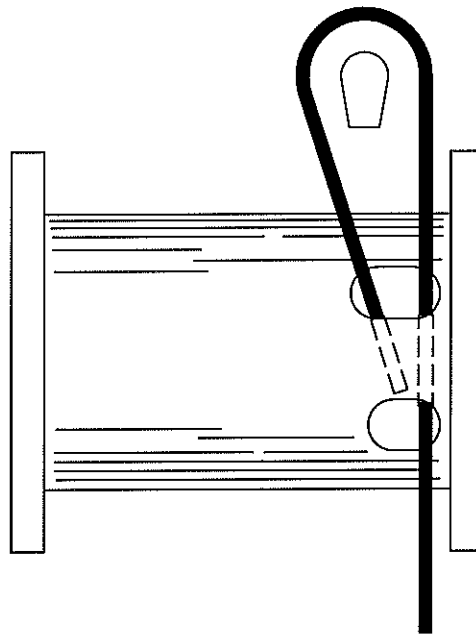
7 TIMES ROPE DIAMETER
(MINIMUM)

3 TIMES ROPE
DIAMETER MAXIMUM

ALLOWABLE METHODS FOR SECURING
DEAD ENDS OF WEDGE SOCKET ATTACHMENTS

ANCHORING WIRE ROPE

INSERT CABLE ANCHOR
SMALL END FIRST.



CH175A

MAIN HOIST - 5/8" WIRE ROPE

Anchoring wire rope on the hoist is very easy. Take the free end of the wire rope and insert it through the small opening of the anchor pocket. Loop the wire rope and push the free end about 3/4 of the way back through the pocket. Install the wedge, then pull the slack out of the wire rope. The wedge will slip into the pocket and secure the wire rope into the drum.

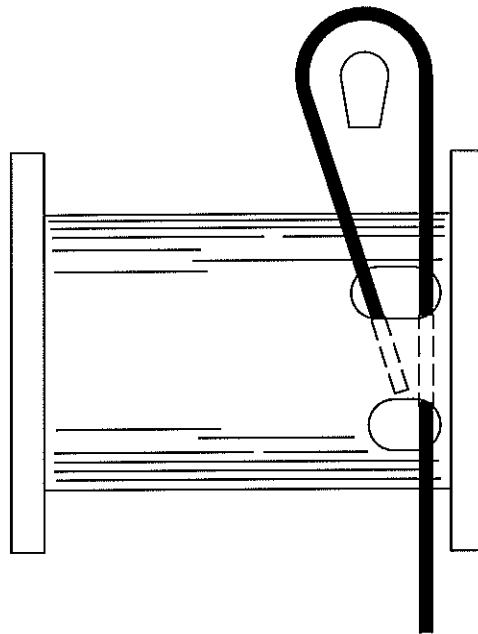
WARNING:



The cable anchor alone on hoists are not designed to hold rated loads. Therefore, a minimum of 5 wraps of cable must be left on the drum barrel to achieve rated load.

ANCHORING WIRE ROPE

INSERT CABLE ANCHOR
SMALL END FIRST.



BG8

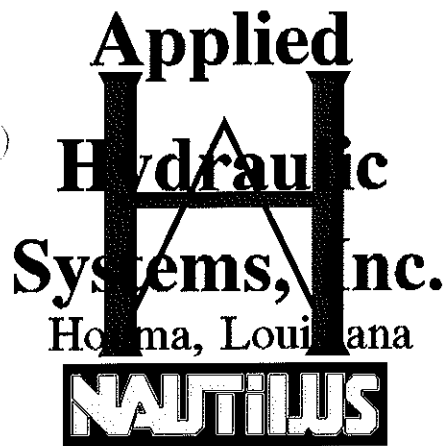
AUXILLARY HOIST—1/2" WIRE ROPE

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WARNING:



The cable anchor alone on hoists are not designed to hold rated loads. Therefore, a minimum of 5 wraps of cable must be left on the drum barrel to achieve rated load.



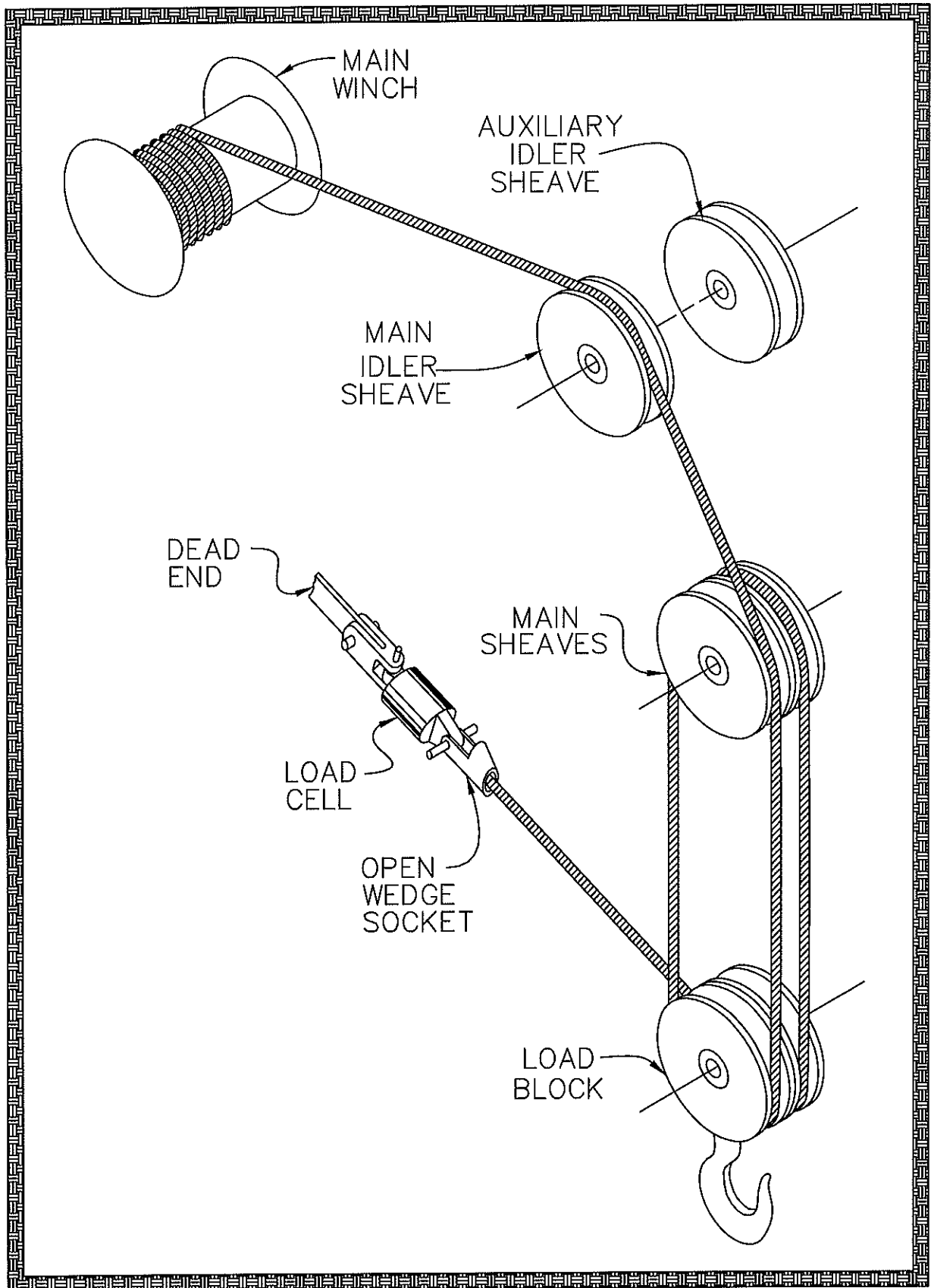
WIRE ROPE BREAK – IN PROCEDURE

After properly installing the new rope, run the new rope through the crane operating cycle several times under a light load at a reduced line speed.

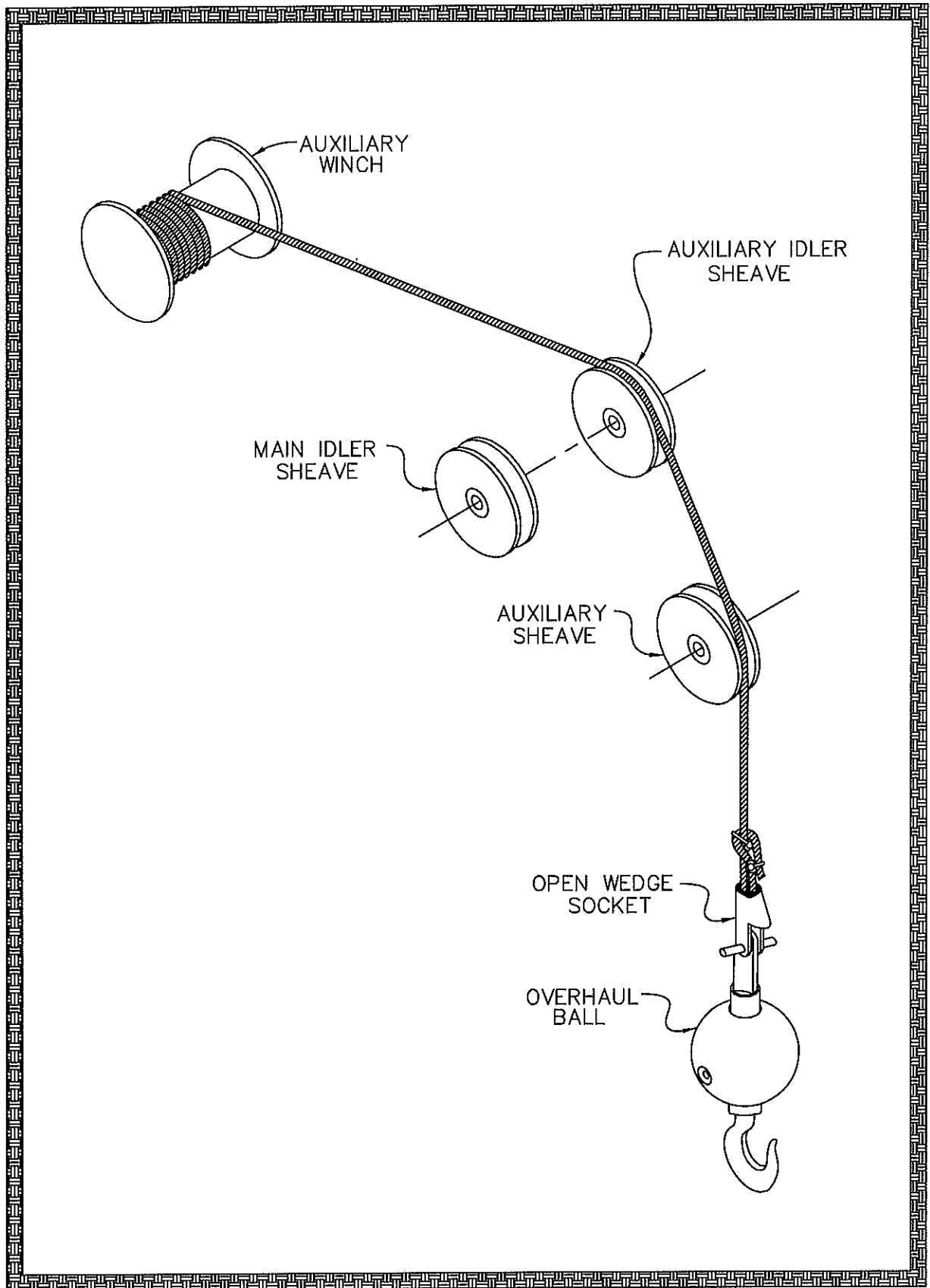
Progressively increase the loads until reaching the entire range of expected lifts.

As you increase the loads, run each load weight from light to maximum expected load at least six times before proceeding, especially when the crane operator will make a series of heavy lifts with new ropes.

This allows the rope to adjust gradually to working conditions, enables the strands to become settled and allows for slight stretching and diameter reduction to occur.



REEVING DIAGRAM
4 PART LINE



REEVING DIAGRAM
1 PART LINE

SECTION 3
CRANE OPERATION

SERVICE ASSISTANCE & ORDERING INFORMATION

24 Hours a Day

INTRODUCTION

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OPERATION GUIDELINES

As the crane operator you should be qualified in accordance with the latest edition of API RP2D, Recommended Practice For Operation and Maintenance of Offshore Cranes. You must insure that riggers, signalmen, and other personnel associated with your lift are suitably trained and informed. You must be completely familiar with the individual crane operating characteristics and controls since they often vary from crane to crane. You must be familiar with the individual crane operation and maintenance manual. It may identify features which are critical to the safe operation of the individual machine.

By their nature cranes are dangerous to operate and are sensitive to mishandling. You must consider any factors that could reduce crane capacity including:

Load swing, hoisting impacts, wind conditions, sea state, experience of personnel, condition of equipment, proper rigging technique, difficulty in centering boom tip over load, etc.

Observe extreme precaution when hazards are present such as:

Limited visibility, blind lifts, helicopter activities, electrical lines, hazardous surroundings, personnel lifts, high boom angles, heavy lifts, hook near boom tip, poor weather conditions, etc.

In such conditions you must judge to what degree operations or capacities are to be limited, or if operations should cease.

Always perform a pre-use inspection to ensure that hazards are not present (rope fouled or damaged, pins unsecured, fuel leak, corrosion present, boom dented, cracked weld, etc.). You must determine that the equipment condition is suitable before resuming operations.

Be familiar with and completely understand the load chart. Be able to determine the crane's actual net lifting capacity. Beware that the winch or boom capacity may be far greater than the weight that can be safely lifted. Recall the most fundamental lift rules:

Always know the load - before it is lifted.

Boom angle / load radius must be known.

Capacity of equipment must be ample at the lift radius.

Operate all functions smoothly avoiding jerking or sudden stops and starts. This will prevent damage or failure from shock loading.

The swing function requires extra care. Sudden motions with long booms or heavy lifts will cause the boom to bend sideways. This causes premature failure of the heel pin bearings and, if severe, could collapse the boom. Limit swing speed to prevent the load from swinging out beyond the intended radius (load swing).

With telescopic boom cranes, set the boom length prior to lifting loads when possible. Note that you may not be able to extend the boom under load because of varying friction conditions.

Two-blocking, where the hook block contacts the boom tip, can cause the rope to break and the load to fall. This may result in equipment damage, injury, or even death. It can occur when hoisting up, telescoping out, and sometimes, when booming down. Observe extreme precaution when the hook block is near the boom tip, when speeds are high, or when two functions are operated simultaneously. Never rely on the anti-two-blocking as an operating tool, only a back-up safety device.

Observe extreme precaution at very high boom angles to prevent contact of the boom with the boom stop on rope supported booms. This can cause subsequent bending or collapse of the boom. Note that when unloaded the boom may "spring back", and contact the stop. Do not disable boom angle limiting devices. For cranes with hydraulic cylinder supported booms - do not stop the boom by fully extending the cylinder unless done very slowly. Impact forces of a fast moving boom could possibly break the cylinder and allow the boom to topple over backwards.

The boom angle is only an indication of operating radius and should be confirmed for critical lifts. Measure the load radius from the center of crane rotation.

Do not operate the crane when temperatures are less than the minimum service temperature stated on the crane monogram. Steels become brittle at low temperatures and the crane may fail at loads well below the normal capacity.

Maintain the load directly below the boom tip. Side loads can cause the hoist rope to climb out of the sheave, resulting in damage to the rope, sheave, and pin, or even breaking of the rope. Side loading with long booms, heavy lifts, or if severe can cause the swing gear train to fracture (with loss of control) or even cause the boom to collapse. Off loads (the load is at a greater radius than the boom tip) tend to amplify the toppling effect of loads on the crane. This can overload the entire crane structure, notably the pedestal and swing bearing.

Take extra care to pay out rope in a smooth manner to prevent slack forming in the rope. Offshore hydraulic cranes, because of power lowering and high winch speeds, are particularly susceptible to rope fouling on the winch drum. Watch for trapped loops, bird nesting, etc. on the winch drum.

ABOUT LOAD CHARTS

STATIC CONDITIONS

To be considered a static lift the following conditions must be true:

The machine has a true vertical axis (a level machine with zero list, zero trim).

The load is directly below boom tip (zero offlead and zero sidelead). Note that a 2% design side lead accounts only for inertial affects of gently swinging the load - not for side loads.

The load is smoothly lifted from or landed upon a motionless surface (no hoisting impact such as jerking loads or suddenly stopping a falling load).

No wind, ice, or other detrimental conditions are present.

DYNAMIC CONDITIONS:

The dynamic rated load can be lifted in specific conditions encountered when relative motion exists between the crane and the load to be lifted/landed. Such cases exist when the crane is on a stationary platform and the load is to be lifted/landed on a marine vessel. The specific conditions include significant wave height, offlead, sidelead, and wind conditions.

In cases where sea conditions are not specified by the purchaser; wind, offlead and sidelead are taken as zero (see API SPECIFICATION 2C) and a dynamic coefficient of 2 is used. Note that this condition is considered appropriate only when:

- Mild seas are encountered (example: maximum sea state of 4 in Gulf of Mexico).
- The vessel position is maintained to eliminate sidelead and offlead (due to drifting of the vessel away from the boom tip).

The dynamic coefficient is basically an impact factor used to insure that crane strength limits are not exceeded. For fixed platform cranes it is calculated based on crane flexibility, hook speed up, and vessel deck speed down. It is affected by wave conditions, vessel size, height of boom tip above the vessel, reeving parts of line and other factors. Assumptions are made of vessel size and statistical determinations are made to estimate vessel deck speed down.

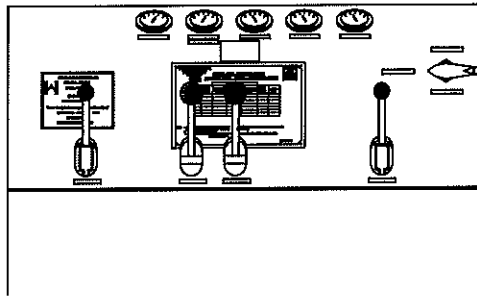
MAINTENANCE AND INSPECTION GUIDELINES

The crane must be regularly maintained and inspected by qualified personnel in accordance with the latest edition of API RP 2D Recommended Practice For Operation and Maintenance of Offshore Cranes.

Since pedestal cranes do not tip over, they are particularly subject to accidental overloads. For this reason it is important to check for damage - periodically, before critical lifts, and after suspected overloads.

Some components possess stored energy which can be released in an uncontrolled manner. Improper handling can result in injury, damage or death. It is important to carefully de-energize these components prior to performing any work. Examples include:

- **Elevated boom** - lower boom into rest prior to working on boom hoist, boom ropes, boom cylinder, bridle, etc. Block or support boom as required prior to disassembling boom to prevent collapse of unsupported sections.
- **Pressurized vessels** - bleed pressure off before disconnecting lines, etc.
- **Rotating machinery** - arrest all motion prior to commencing work.



GENERAL OPERATION OF CRANE



1. Always operate crane within the capacity rating (see your lifting chart). Know the weight of the load you are lifting.
2. Never operate with anyone under the load or swing over personnel.
3. Know and follow recommended hand signals.
4. Do not leave crane unattended while load is suspended or crane is operating.
5. Parking brake should always be set before leaving crane.

WARNING



FAILURE TO FOLLOW ABOVE PROCEDURES COULD
RESULT IN PROPERTY DAMAGE, SEVERE PERSONAL
INJURY, OR DEATH!

OPERATION CAUTION

Do not operate crane unless you thoroughly understand the controls and operation of the crane and required maintenance has been performed on the crane.

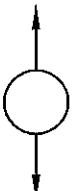
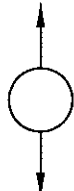
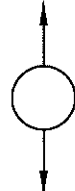
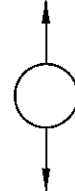
CAUTION



1. Check all scheduled maintenance items, including proper lubrication of ballring and hydraulic oil level.
2. Check all pin connections and inspect ballring bolts for looseness and corrosion.
3. Start prime mover and check crane operation - without load.
4. Always be certain that wire rope reeving is in correct position before operating crane.

CRANE OPERATION

LEVER CONTROLS: BASIC FOUR LEVER CRANE CONTROL DIAGRAM (VIEWED FROM OPERATOR'S STATION)

SWING	AUXILIARY HOIST	MAIN HOIST	BOOM
PUSH - LEFT	PUSH TO LOWER	PUSH TO LOWER	PUSH TO LOWER
			
PULL - RIGHT	PULL TO RAISE	PULL TO RAISE	PULL TO RAISE

FOUR LEVER CRANE CONTROL FUNCTIONS

CONTROL

- | | |
|----------------------------|---|
| 1. SWING CONTROL | Push lever to swing crane to the left. The center (neutral) is to stop. Pull lever to swing crane to the right. |
| 2. AUXILIARY HOIST CONTROL | Push lever to lower load. The center (neutral) is to stop. Pull lever to hoist load. |
| 3. MAIN HOIST CONTROL | Push lever to lower load. The center (neutral) is to stop. Pull lever to raise load. |
| 4. BOOM CONTROL | Push lever to lower boom. The center (neutral) is to stop. Pull lever to raise boom. |

CAUTION:



During operation, the control lever should be metered slowly when starting or stopping an operation to prevent harsh stresses on the hydraulic system and the equipment. All movements should be smooth. Avoid jerking. Extra caution should be taken when boom is in a full horizontal position or when moving heavy loads.

5. ANTI-TWO BLOCK OVERRIDE VALVE
Located on the left side wall of the cab. Handle must be depressed and held to override the Anti-Two Blocking System.
6. ENGINE START VALVE
Located on the left side wall of the cab. Push button to start to start engine.
7. FOOT DYNAMIC SWING BRAKE ACTUATOR
Located on the left side floor of the control station. Depress the pedal to slowly stop swing of crane.
8. ENGINE FOOT THROTTLE ACTUATOR
Engine power and speed is controlled by using the foot pedal located on the right side floor of the control station. Depress pedal to accelerate the engine. Release to idle the engine. Pedal is spring loaded to idle.
9. ENGINE KILL CABLE
Located to the right side of the operator's seat. Pull lever to shut off fuel intake causing engine to shut down.
10. EMERGENCY ENGINE KILL CABLE
Located on the right side of the operator's seat. Pull lever to shut off air intake causing engine to shut down.
11. PARKING BRAKE VALVE
Located on the right side of the operator's seat. Must be depressed to set the parking brake. Set the parking brake only when crane has stopped swinging.

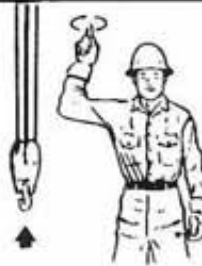
CAUTION: This crane is equipped with free swing capability. Crane must be completely stopped before engaging parking brake. Do not use parking brake to stop swing of crane.



CRANE SIGNALS



Nautilus Marine Cranes
Houma, Louisiana (985) 868-0630



HOIST
With forearm vertical, forefinger pointing up, move hand in small horizontal circle



LOWER
With arm extended downward, forefinger pointing down, move hand in small horizontal circles



USE MAIN HOIST
Tap fist on head; then use regular signals



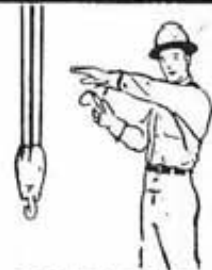
USE WHIP LINE
(Auxiliary Hoist)
Tap elbow with one hand; then use regular signals



RAISE BOOM
Arm extended, fingers closed thumb pointing upward



LOWER BOOM
Arm extended fingers closed, thumb pointing downward



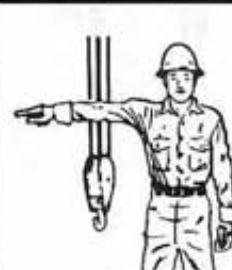
MOVE SLOWLY
Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist Slowly shown as example)



RAISE THE BOOM AND LOWER THE LOAD
With arm extended thumb point up, flex fingers in and out as long as load movement is desired.



LOWER THE BOOM AND RAISE THE LOAD
With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.



SWING
Arm extended point with finger in direction of swing of boom



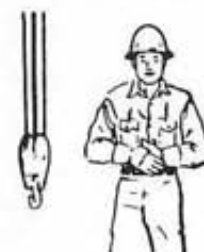
STOP
Arm extended, palm down, hold position rigidly.



EMERGENCY STOP
Arm extended, palm down, move hand rapidly right and left.



TRAVEL
Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.

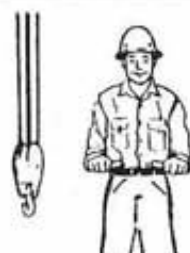


DOG EVERYTHING
Clasp hands in front of body.

CRANE SIGNALS FOR TELESCOPING BOOM



EXTEND BOOM
Both fists in front of body with thumbs pointing outward.



RETRACT BOOM
Both fists in front of body with thumbs pointing toward each other.



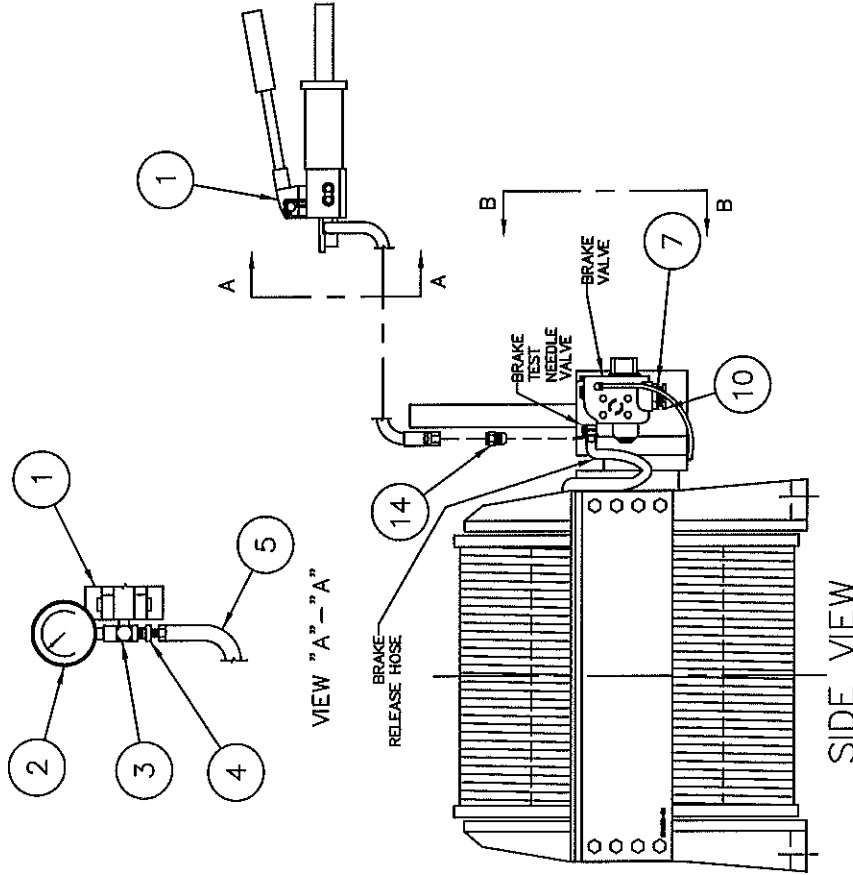
EXTEND BOOM
One Hand Signal. One fist in front of chest with thumb tapping chest.



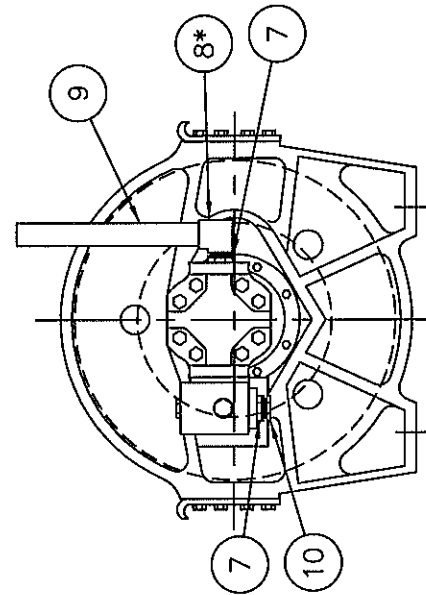
RETRACT BOOM
One Hand Signal. One fist in front of chest, thumb pointing outward and heel of fist tapping chest.

BILL OF MATERIAL

ITEM	QTY.	PART NUMBER / MATERIAL SPEC.	DESCRIPTION	ACTUAL WEIGHT (LBS)
1	1	N45215	HAND PUMP	
2	1	N45844-029	3000 PS DIRECT MOUNT PRESSURE GAUGE WITH 2-1/2" FACE	
3	1	N40044-040	1/4" TEE, MNPT x MNPT x FNPT (2093-4-4S)	
4	1	N40063-040	ADAPTOR, 1/4" MJIC x 1/4" FNPT (2022-4-4S)	
5	1	N76404-120	HOSE ASSEMBLY, 1/4" DIA. X 5 FT. LONG WITH 1/4" FJC SWIVEL ENDS (2500 PSI)	
6	-	-	-	
7	2	N46850-024	1-1/2" ANCHOR FLANGE, CODE 61	
8	1	N40039-240	90° ELBOW 1-1/2" FNPT x 1-1/2" MNPT (2089-24-24S)	
9	1	N46964-024	STAND PIPE, 1-1/2" DIA. SCH 40 X 12" LONG (THREAD ONE END ONLY)	
10	1	N40169-240	PLUG, 1-1/2" NPT (2082-24S)	
11	1	-	1/4" JIC CAP	
12	1	N40038-240	90° ELBOW, 1-1/2" FNPT x 1-1/2" FNPT (2087-24-24)	
13	1	N40030-240	NIPPLE, 1-1/2" MNPT x 1-1/2" MNPT (2083-24-24S)	
14	1	2027-4-4	UNION, 1/4" JIC FITTING	
15	1	N46649-002	TOOL BOX	



* IF THE PORT IS FACING DOWN USE ITEM 8, ITEM 13, AND ITEM 12 WITH ITEM 9 AND ITEM 7 -- SEE VIEW "B"-B"



FRONT VIEW

APPLIED HYDRAULIC SYSTEMS, INC.

Manufacturer of
NAUTILUS
Marine Cranes

Sales & Service
(804) 851-5600
Fax No. (804) 851-0754

Manufacturing Plant
204 Industrial Ave. C
Houma, LA 70363

EMERGENCY LOAD
LOWERING KIT INSTRUCTIONS
CH SERIES

DWG. NO. N95SK5-040

SCALE: NOT TO SCALE

DRAWN BY: ANTHONY

DATE: 11/24/95 APPD BY: [Signature] SHT 1 OF 2

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REVISIONS	DESCRIPTION
DATE: 4/17/97 BY: CHERYL APP'D: [Signature] ITEM #15 REPLACED AS SHOWN	A
DATE: 8/10/99 BY: CHERYL APP'D: [Signature] UPDATE ITEM 2 FROM N45844-008	B

EMERGENCY LOWERING PROCEDURE

CH SERIES HOIST ONLY

1. DISCONNECT THE BRAKE RELEASE HOSE FROM THE BRAKE TEST NEEDLE VALVE, PUT 1/4" JIC CAP (ITEM 11) ON OPEN FITTING, REMOVE LOCKWIRE ON BRAKE TEST NEEDLE VALVE AND CLOSE VALVE. (REF. SHEET 1)
2. INSTALL 1/4" UNION (ITEM 14) IN BRAKE RELEASE HOSE DISCONNECTED FROM NEEDLE VALVE.
3. INSTALL PRESSURE GAUGE (ITEM 2), HOSE (ITEM 5), 1/4" TEE (ITEM 3) AND 1/4" ADAPTER (ITEM 4) ON HAND PUMP (ITEM 1). (REF. SHEET 1)
4. ATTACH HAND PUMP HOSE (ITEM 5) TO 1/4" UNION (ITEM 14).
5. REMOVE BOTH MAIN HOSES FROM THE MOTOR AND ATTACH A STAND PIPE TO THE MOTOR PORT ON THE OPPOSITE SIDE OF THE MOTOR FROM THE BRAKE VALVE USING ITEMS 7, 8 & 9. THE STAND PIPE MUST BE INSTALLED VERTICALLY. (REF. SHEET 1)
6. INSTALL 1-1/2" ANCHOR FLANGE (ITEM 7) ON BRAKE VALVE WITH PLUG (ITEM 10).
7. FILL THE STAND PIPE (ITEM 9) WITH HYDRAULIC OIL.

!CAUTION!

THIS EMERGENCY LOWERING PROCEDURE OPENS THE MULTIPLE-DISC BRAKE WHILE LEAVING THE BRAKE VALVE CLOSED. SINCE GEAR TYPE MOTORS ARE NOT ZERO LEAK DEVICES, INTERNAL MOTOR LEAKAGE PERMITS THE LOAD TO SLOWLY ROTATE THE MOTOR EVEN THOUGH THE OUTLET IS BLOCKED BY THE CLOSED BRAKE VALVE AND THE PLUG (ITEM 10). THIS PROCEDURE WILL NOT WORK IF THERE IS LITTLE OR NO OIL IN THE MOTOR. ATTEMPTING TO USE THIS PROCEDURE WITH NO OIL IN THE MOTOR WILL CAUSE THE LOAD TO FREE FALL. THE PURPOSE OF THE STAND PIPE IS TO INSURE THAT THE MOTOR IS FULL OF OIL. THE STAND PIPE IS SIMPLY A LENGTH OF PIPE ABOUT ONE (1) FOOT LONG (31 CM), ATTACHED TO A 90° ELBOW. THE OTHER END OF THE ELBOW IS ATTACHED TO A SHORT FITTING SUITABLE FOR MOUNTING ON THE MOTOR PORT OR MANIFOLD. THE STAND PIPE IS INSTALLED WITH THE PIPE POINTED IN A VERTICAL POSITION. WHILE LOWERING, OIL SHOULD BE ADDED TO THE STAND PIPE AS NECESSARY. THE PIPE DIAMETER SHOULD BE EQUAL TO OR LARGER THAN THE MOTOR PORT DIAMETER.

8. WITH THE HAND PUMP, SLOWLY APPLY 500-750 LBS. HYDRAULIC PRESSURE TO THE BRAKE RELEASE PORT WHILE CONSTANTLY MONITORING THE DESCENT OF THE LOAD. RELEASING THE PRESSURE ON THE HAND PUMP WILL CAUSE THE BRAKE TO RE-APPLY AND STOP THE LOAD. IF A CHATTERING NOISE IS HEARD WHILE THE LOAD IS COMING DOWN, PUMP THE HAND PUMP TO A HIGHER PRESSURE (DO NOT EXCEED 1000 PSI) UNTIL THE NOISE STOPS. DO NOT TOUCH THE MOTOR OR STAND PIPE WHILE USING THIS PROCEDURE; THESE ITEMS BECOME VERY HOT.
9. WHEN LOAD LOWERING IS COMPLETED, REVERSE THIS PROCEDURE AND SAFETY WIRE THE BRAKE TEST NEEDLE VALVE OPEN.

APPLIED HYDRAULIC SYSTEMS, INC.

Manufacturer of
NAUTILUS
Marine Cranes

Sales & Service
(504) 851-3600
Fax No. (504) 851-0754
Manufacturing Plant
204 Industrial Ave. C
Houma, LA 70363

EMERGENCY LOWERING
PROCEDURE
CH HOIST ONLY

DWG. NO. N95SK5-040

A

SCALE: NOT TO SCALE DRAWN BY: PHZ

DATE: 11/28/95 APPD BY: FJH SH 2 OF 2

DESCRIPTION

REVISIONS

DATE:

APPD:

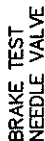
BY:

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SH 2 OF 2

N95SK5-040

DWG



PLUGS, 1-1,

[illegible]

EMERGENCY LOWERING PROCEDURE

PD/BG8 SERIES HOISTS

1. REMOVE THE LOCKWIRE ON THE NEEDLE VALVE HANDLE AND CLOSE THE BRAKE TEST NEEDLE VALVE TIGHTLY. (REF. SHEET 1)
2. INSTALL PRESSURE GAUGE (ITEM 2), HOSE (ITEM 5), 1/4" TEE (ITEM 3) AND 1/4" ADAPTER (ITEM 4) ON HAND PUMP (ITEM 1) - (REF. SHEET 1)
3. REMOVE BOTH MAIN HOSES FROM THE WINCH MOTOR AND ATTACH A STAND PIPE TO THE MOTOR PORT ON THE OPPOSITE SIDE OF THE MOTOR FROM THE BRAKE VALVE USING ITEMS 7, 8, 9 & 19. THE STAND PIPE MUST BE INSTALLED VERTICALLY. (REF. SHEET 1)
4. INSTALL PLUG IN BRAKE VALVE ACCORDING TO HOSE SIZE AT HOIST. FOR 1/2" HOSE - SEE ITEMS 13 & 14; FOR 3/4" HOSE - SEE ITEMS 15 & 16; AND FOR 1" HOSE - SEE ITEMS 17 & 18.
5. FILL THE STAND PIPE (ITEM 9) WITH HYDRAULIC OIL.
6. REMOVE THE JIC CAP ON BRAKE PORT TEE. (REF. SHEET 1)
7. CONNECT HOSE (ITEM 5) FROM HAND PUMP TO THE OPENING ON THE BRAKE PORT TEE. (REF. SHEET 1)

!CAUTION!

THIS EMERGENCY LOWERING PROCEDURE OPENS THE MULTIPLE-DISC BRAKE WHILE LEAVING THE BRAKE VALVE CLOSED. SINCE GEAR TYPE MOTORS ARE NOT ZERO LEAK DEVICES, INTERNAL MOTOR LEAKAGE PERMITS THE LOAD TO SLOWLY ROTATE THE MOTOR EVEN THOUGH ITS OUTLET IS BLOCKED BY THE CLOSED BRAKE VALVE AND THE PLUG (ITEM 11). THIS PROCEDURE WILL NOT WORK IF THERE IS LITTLE OR NO OIL IN THE MOTOR. ATTEMPTING TO USE THIS PROCEDURE WITH NO OIL IN THE MOTOR WILL CAUSE THE LOAD TO FREE FALL. THE PURPOSE OF THE STAND PIPE IS TO INSURE THAT THE MOTOR IS FULL OF OIL. THE STAND PIPE IS SIMPLY A LENGTH OF PIPE ABOUT ONE (1) FOOT LONG (31 CM), ATTACHED TO A 90° ELBOW. THE OTHER END OF THE ELBOW IS ATTACHED TO A SHORT FITTING SUITABLE FOR MOUNTING ON THE MOTOR PORT OR MANIFOLD. THAT STAND PIPE IS INSTALLED WITH THE PIPE POINTED IN A VERTICAL POSITION. WHILE LOWERING, OIL SHOULD BE ADDED TO THE STAND PIPE AS NECESSARY. THE PIPE DIAMETER SHOULD BE EQUAL TO OR LARGER THAN THE MOTOR PORT DIAMETER.

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204 Industrial Ave. C
Houma, LA 70363

EMERGENCY LOWERING
PROCEDURE
PD/BG8 HOISTS SERIES

DWG. NO. N95SK5-041

△

SCALE: NTS

DRAWN BY: PHZ

DATE: 11/28/95 APPD BY: T.H. SHIT 2 OF 2

DESCRIPTION

REVISIONS

DATE:

APPD.

BY:

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Sht. 2 of 2

N95SK5-041

DWG

LUFFING CYLINDER CAUTION

READ THIS BEFORE USING THIS CYLINDER



END OF STROKE IMPACT



STANDARD CYLINDERS DO NOT CONTAIN CUSHIONED STOPS, THEREFORE ARE NOT DESIGNED TO ACCOMMODATE HIGH IMPACT FORCES RESULTING FROM HIGH STROKE VELOCITIES OR A HEAVY MOVING MASS.

LOAD APPLICATION RESTRICTIONS

STANDARD CYLINDERS ARE PRESSURE TESTED AT 3,000 PSI AND SHOULD NOT EXCEED THIS PRESSURE.

DUE TO A SMALLER AREA, STANDARD CYLINDERS WILL RETRACT AT A FASTER RATE THAN THEY WILL EXTEND USING THE SAME AMOUNT OF OIL AND FORCE.

PURGE ALL AIR BEFORE USING, FAILING TO PURGE ALL AIR FROM CYLINDER CAN RESULT IN DAMAGE TO CYLINDER, AND MAY CAUSE INJURY.

IT IS THE USER'S RESPONSIBILITY TO OPERATE THIS CYLINDER SAFELY AND NOT TO EXCEED THE CAPABILITIES OF DESIGN OF THIS CYLINDER.

SECTION 4

CRANE MAINTENANCE

SERVICE ASSISTANCE & ORDERING INFORMATION

24 Hours a Day

INTRODUCTION

This section contains information for ordering replacement parts for the equipment.



NOTE: CERTIFIED OEM REPLACEMENT PARTS CONTAIN NAUTILUS PART NUMBERS. INFORMATION ON PARTS NOT LISTED IN THIS MANUAL MUST BE RECEIVED FROM OSI NAUTILUS CRANE FOR PROPER VALIDATION AS NON-OEM PARTS MAY NOT MEET PERFORMANCE STANDARDS. ANY REPAIRS MADE WITH NON-OEM PARTS COULD EFFECT SAFE OPERATIONS OF THE CRANE AND CAUSE POSSIBLE PERSONNEL INJURY.

PARTS DELIVERY

To ensure prompt delivery of parts, be sure to give the correct name, address, town, state and country to which the parts are to be shipped. Include the Zip Code, if applicable, and specify the type of shipment. If the type of shipment is not specified, parts will be shipped by the best available means as determined by Oil States Industries.

PARTS AND SERVICE INQUIRIES

If difficulty is encountered with the repair of any assembly / component or if replacement parts are needed for any reason, contact the Oil States Industries Parts and Service Department for assistance at the following:

Oil States Industries
1180 Mulberry Road
Houma, LA 70363 USA

Telephone: (985) 868-0630
Toll Free: (800) 247-5530
Fax: (985) 851-0778

Oil States Industries Thailand Ltd.
450 Sukhumvit Road,
No. 102
Tambol Huaypong
Amphur Muang
Rayong 21150
Thailand

Telephone: + 66 (0) 38 691 643
Fax: + 66 (0) 38 691 644

SECTION IV MAINTENANCE

INTRODUCTION

MAXIMUM CRANE PERFORMANCE IS MAINTAINED BY PROPER UPKEEP AND MAINTENANCE.

The maintenance section provides guidelines for proper upkeep of the crane. The maintenance of your crane falls into two areas (1) Routine Inspection and Service and (2) Scheduled Maintenance. Routine Inspection and Service should be performed each day the crane is operated or each 8 hours of operation. The Routine Inspection & Scheduled Maintenance of your engine, generator*, winch, hydraulic pump, load, and moment indicator system* are specified in the manufacturer's maintenance operation manuals. These manuals are located in Section V - Repair.

* These manuals are included only when these options are installed on crane.



MAINTENANCE PRECAUTIONS

Before maintenance, adjustment, or repair is started on a crane, take the following precautions:

1. Place crane where it will cause the least interference with other equipment or operations in the area.
2. Shut power off and put control in neutral.
3. Set the mechanical swing lock if your crane has a swing lock.
4. Set swing parking brake if your crane is equipped with a manually operated parking brake.
5. Lower boom, if possible, onto boom rest.
6. Lower load block and overhaul ball if needed.
7. Prior to hydraulic system maintenance, bleed off all pressure in each hydraulic circuit. Operate each control lever in a back and forth motion to bleed off the hydraulic circuit pressure.
8. Prior to electrical system maintenance, insure power is off and disconnects are open. Physically disconnect the power supply to the electrical system.

MAINTENANCE PRECAUTIONS

Page 2



AFTER ADJUSTMENTS AND REPAIRS
HAVE BEEN MADE, THE CRANE
SHALL NOT BE RETURNED TO SERVICE
UNTIL ALL GUARDS HAVE BEEN
RE-INSTALLED, TRAPPED AIR REMOVED
FROM HYDRAULIC SYSTEM IF REQUIRED,
SAFETY DEVICES REACTIVATED, AND
MAINTENANCE EQUIPMENT REMOVED.



WHEN CRANE IS NOT IN OPERATION
FOR EXTENDED PERIODS OF TIME,
LUBRICATION OF BALLRING SHOULD
STILL BE PERFORMED AT LEAST EVERY
THREE MONTHS AND A THOROUGH
INSPECTION OF THE WIRE ROPE (S) MADE.

ROUTINE INSPECTION AND SERVICE

CHECK EACH DAY CRANE IS IN OPERATION (BEFORE OPERATING)

BOOM	
SHEAVE PINS	
BOOM FOOT PIN	
LUFFING CYLINDER PINS	
WIRE ROPE & HOIST	
BALLRING/BALLRING BOLTS	
WEDGE SOCKET CONNECTION	
HYDRAULIC HOSES	
PIN KEEPERS AND BOLTS	
HYDRAULIC OIL LEVEL	
ENGINE FUEL LEVEL	
ENGINE COOLANT LEVEL	
ENGINE OIL LEVEL	
LOAD BLOCK/OVERHAUL & SAFETY LATCHES	

DAILY FUNCTIONAL TEST

PERFORM FUNCTIONAL TESTS EACH DAY CRANE IS OPERATED.

TEST ANTI-TWO BLOCK FUNCTION BY RAISING LOAD BLOCK	
TEST ANTI-TWO BLOCK FUNCTION BY RAISING OVERHAUL BALL	
TEST BOOM COUNTERBALANCE VALVES BY LOWERING BOOM WITHOUT LOAD	
TEST PARKING BRAKE VALVE	
ACTIVATE ENGINE KILL CABLE	

NOTES AND PRECAUTIONS

The following maintenance schedule outlines the minimum frequency for thorough inspection, lubrication, and changing specific items.

The lubrication frequency is the maximum length of time between lubrications. The necessary lubrication frequency is dependant on the environment conditions. Over-lubrication of non-sealed fittings (sheave pins, valve spools, wheel bearings, etc.) will not harm the fittings or components, but under-lubrication will definitely lead to a shorter lifetime. Grease fittings that are worn and will not hold the grease gun, or those that have a stuck ball, must be replaced.

On plug-type check points, the oil levels are to be at the bottom edge of the fill point.

An extensive wire rope inspection should be made at least every 100 hours of operation or every three (3) months. A comprehensive explanation of the wire rope inspection is given in the API Recommended Practice 2D (RP2D). Inspect the wire rope for any types of deterioration; distortion, corrosion, broken strands, etc. The listed lubrication frequency is the maximum length of time between lubrications. The necessary lubrication frequency is dependant on the environmental conditions.

MAINTENANCE SCHEDULE

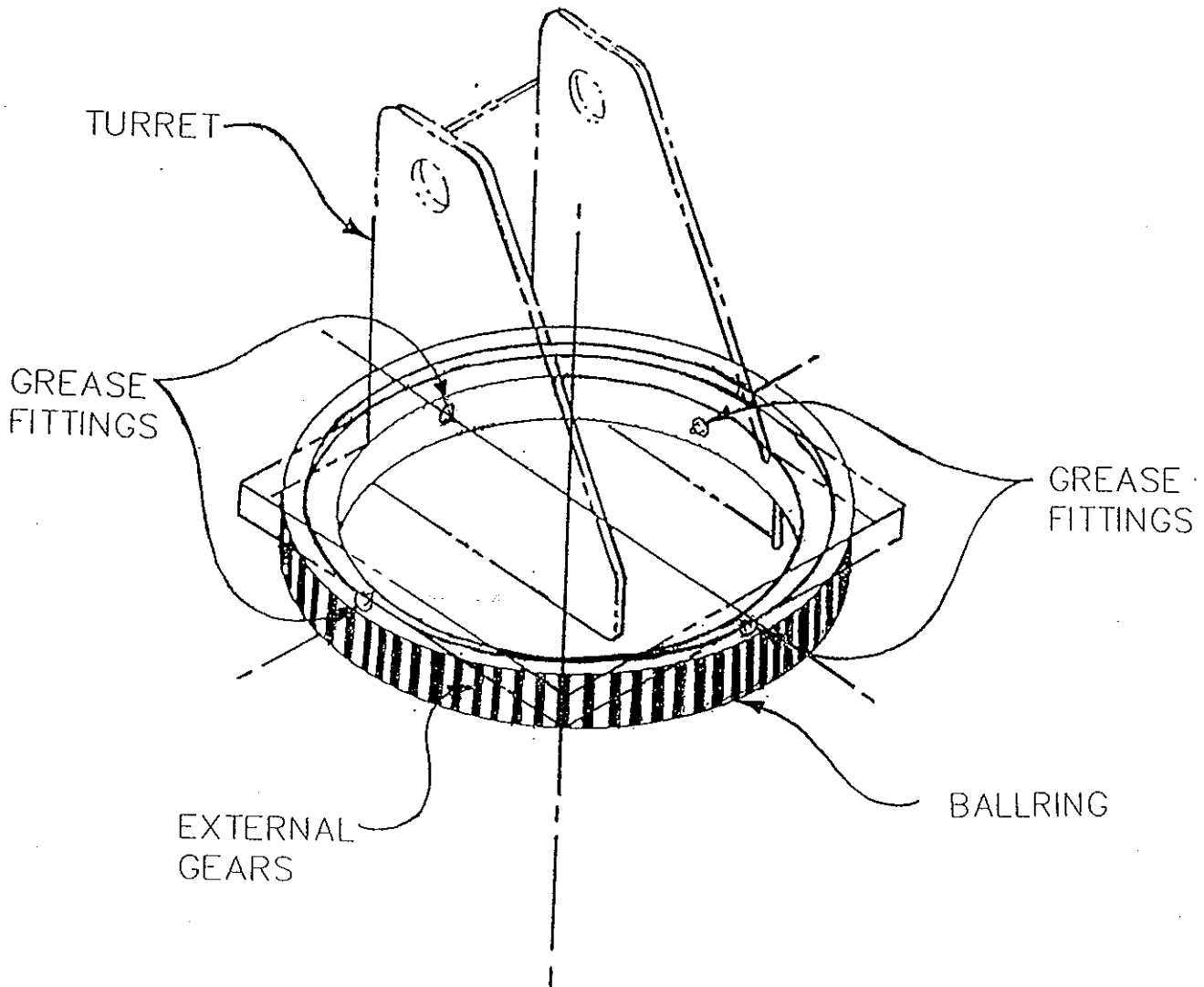
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***CAUTION:** BALLRING AND PEDESTAL BOLTS MUST BE RETORQUED AT THE INTERVALS SHOWN TO PREVENT PREMATURE BEARING WEAR AND/OR FAILURE.

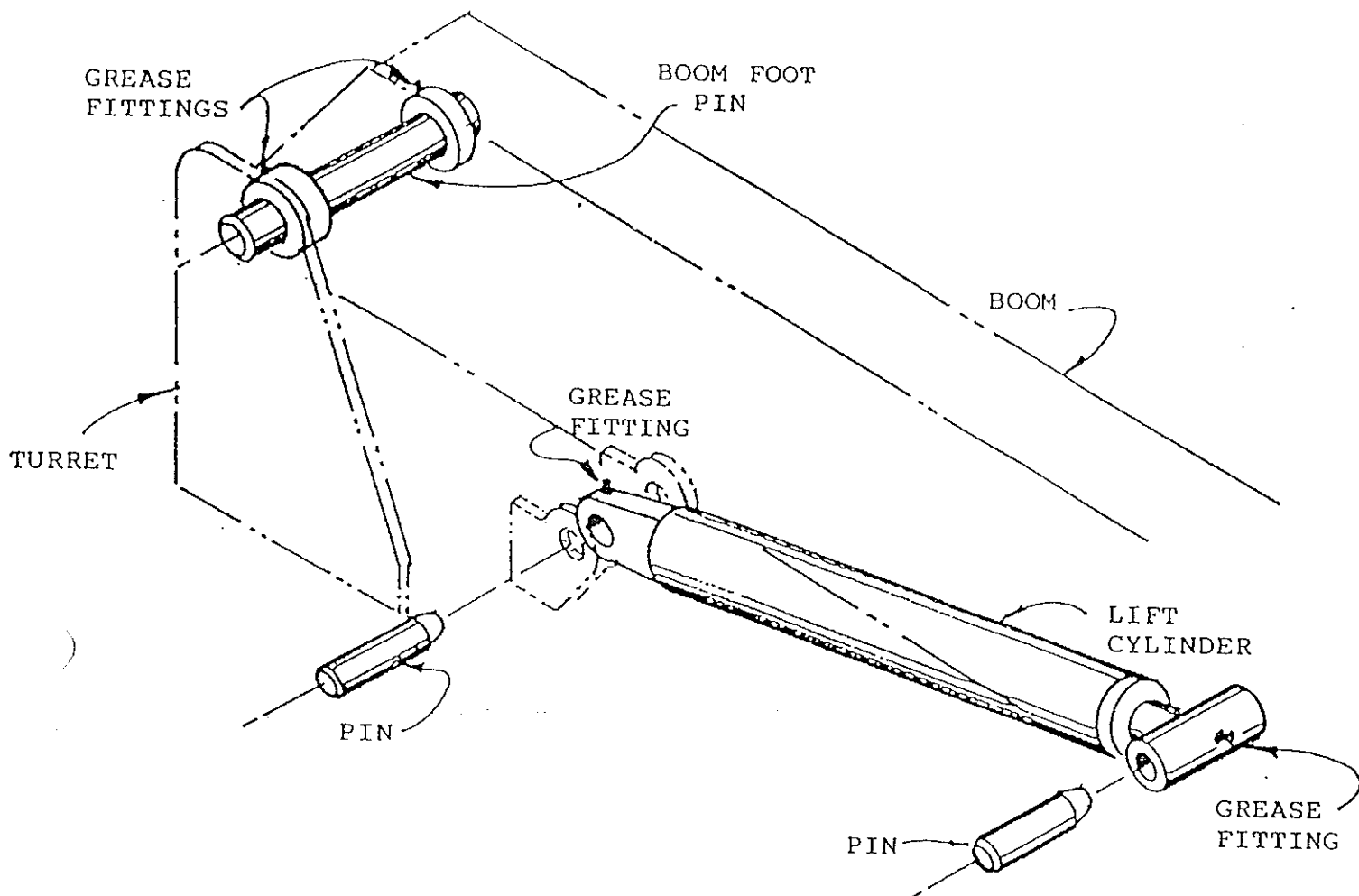
LUBRICATION DIAGRAMS

LUBRICATION PROCEDURE

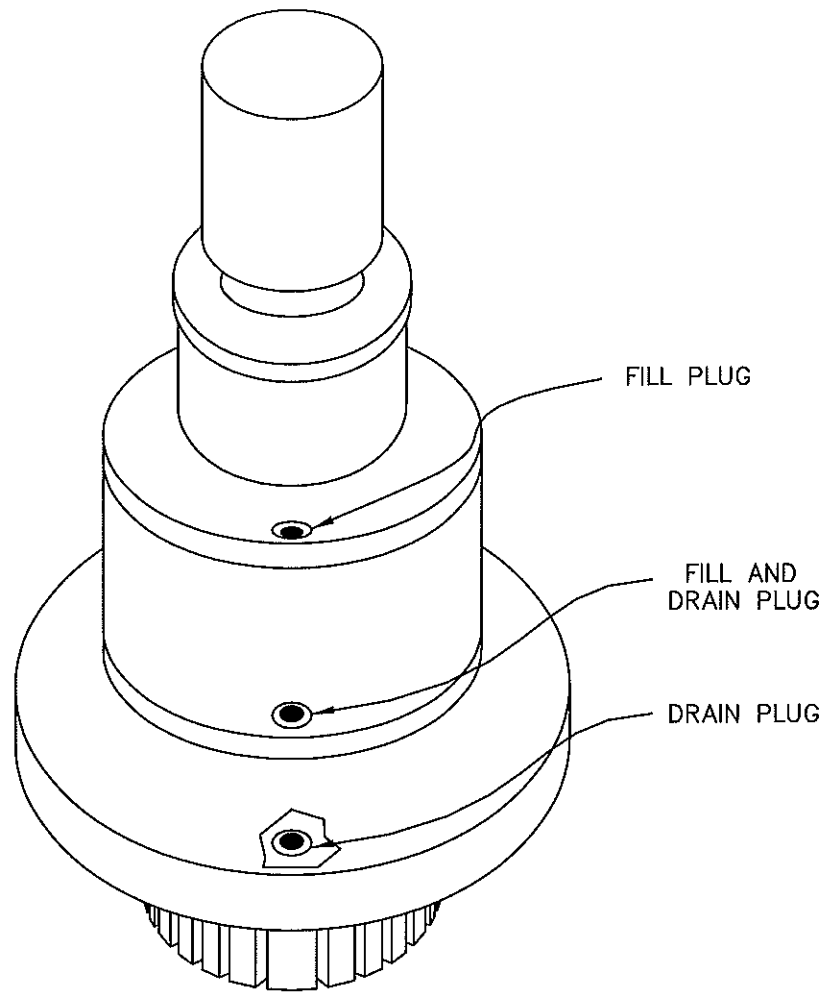
Each bearing is equipped with one or more grease fittings. Models equipped with two or three rows of fittings should be greased on each row. To insure uniform distribution of grease throughout the bearing, the machine should be rotated at least two complete revolutions while greasing. When complete rotation is impractical, grease may be pumped into each fitting, rotating the device back and forth as possible as each fitting is greased. For bearings with integral gears, lubricate gear as necessary to prevent metal-to-metal contact.



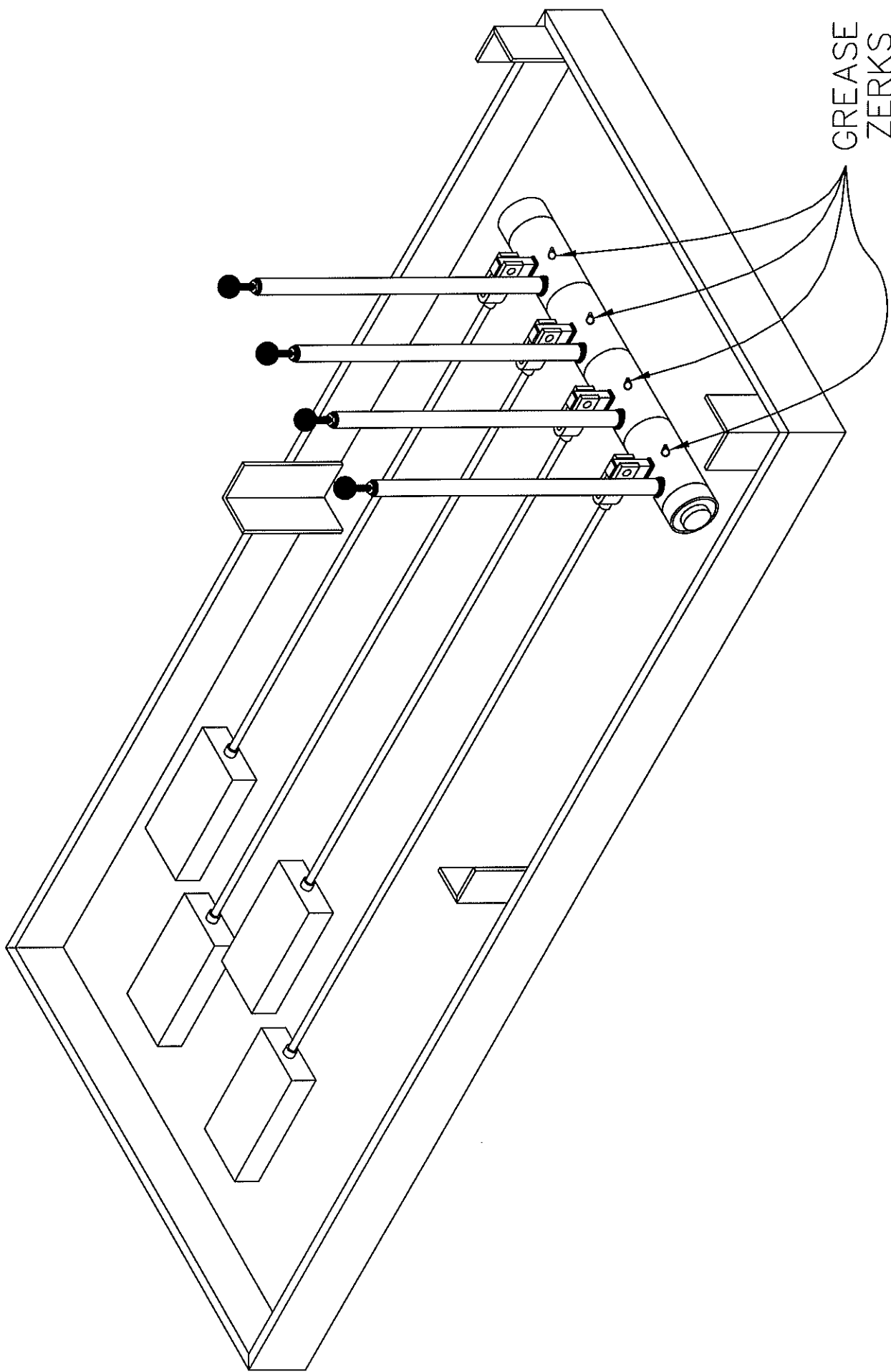
BALLRING LUBRICATION POINTS



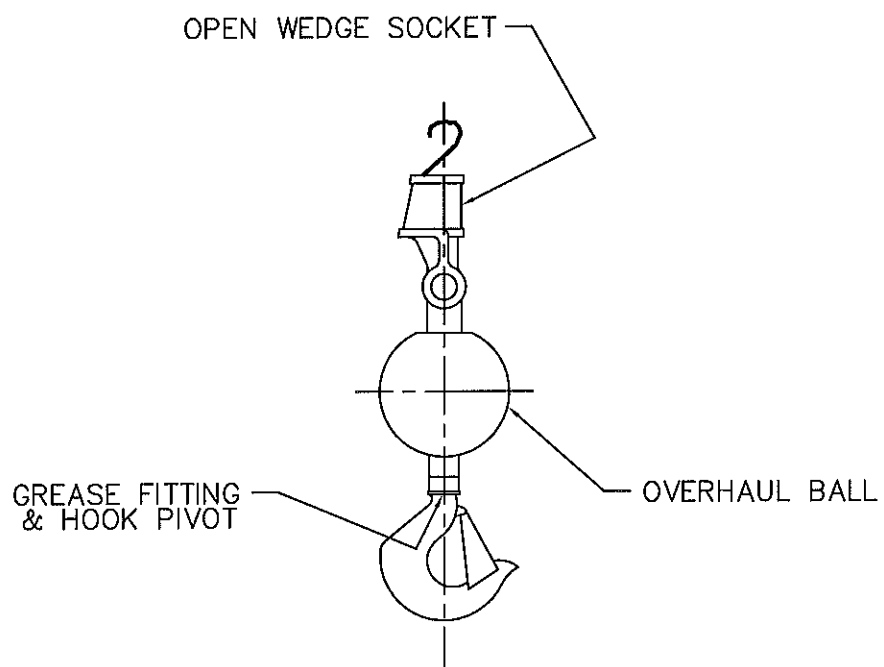
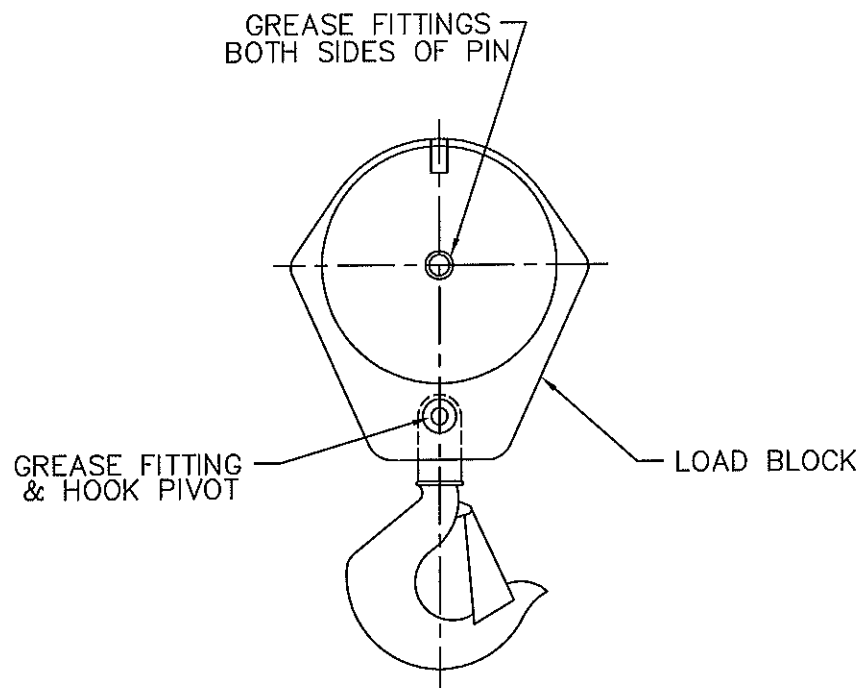
BOOM FOOT PIN
AND LIFT CYLINDER PIN
LUBRICATION POINTS



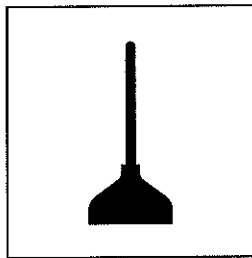
GEARBOX LUBRICATION POINTS



CONTROL VALVE LINKAGE ASSEMBLY



LOAD BLOCK/OVERHAUL BALL LUBRICATION POINTS



HYDRAULIC OIL

RECOMMENDED FLUIDS AND LUBRICANTS

- Viscosity 150–225 SSU @ 100°F
- Viscosity Index 90 Minimum
- Pour Point No Higher Than 20°F
- Neutralization Point 0–05 Maximum
- Compounds For Wear
- Compounds For Anti-Foam
- Compounds For Anti-Rust

SUPPLIER	DESIGNATION
Arco	Duro AW 46 Hydraulic Oil
Conoco	Super Hydraulic Oil 32
CITGO	AW Hydraulic 32
Exxon	NUTO 32
Gulf	Harmony 32 AW
Mobil	DTE 24
Pennzoil	Pennzoil AW 32
Phillips	Magnus A 32
Shell	Tellus 32 (Winter)/ 46 (Summer)
Sun	Sunvis 816 WR
Tenneco	EP 300
Texaco	Rando HD 32
Union	UNAS AW 32



DO NOT USE PHOSPHATE ESTERS.

DO NOT USE SYNTHETIC FLUIDS.

SEALS ARE COMPATIBLE WITH MINERAL BASE FLUIDS ONLY.

GEAR OIL

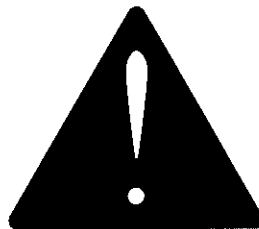
RECOMMENDED HOIST LUBRICANTS

SUPPLIER	DESIGNATOR	AMBIENT TEMPERATURE
TEXACO	Meropa 220/ Equivalent API GL-2/3	+ 50 TO + 130°F
TEXACO	Meropa 150/Equivalent API GL-2/3	- 10 to + 50°F
MOBIL	SCH630 Synthetic	- 40 TO - 10°F

SAE 85w/ 140 – SWING DRIVE

SUPPLIER	DESIGNATION
Conoco	Universal Gear 140w
CITGO	Premium Gear Oil 140w
Exxon	Gear Oil GX 140
Gulf	Multi-Purpose G.L. 140
Mobil	Mobilube HD 140w
Pennzoil	Pennzoil – 140w
Phillips	Philube SMP 140
Shell	Spirex HD 140w
Sun	Sunfleet GL 5 140w
Tenneco	
Texaco	Multigear EP 140w
Union	MP Gear Lube LS 140w

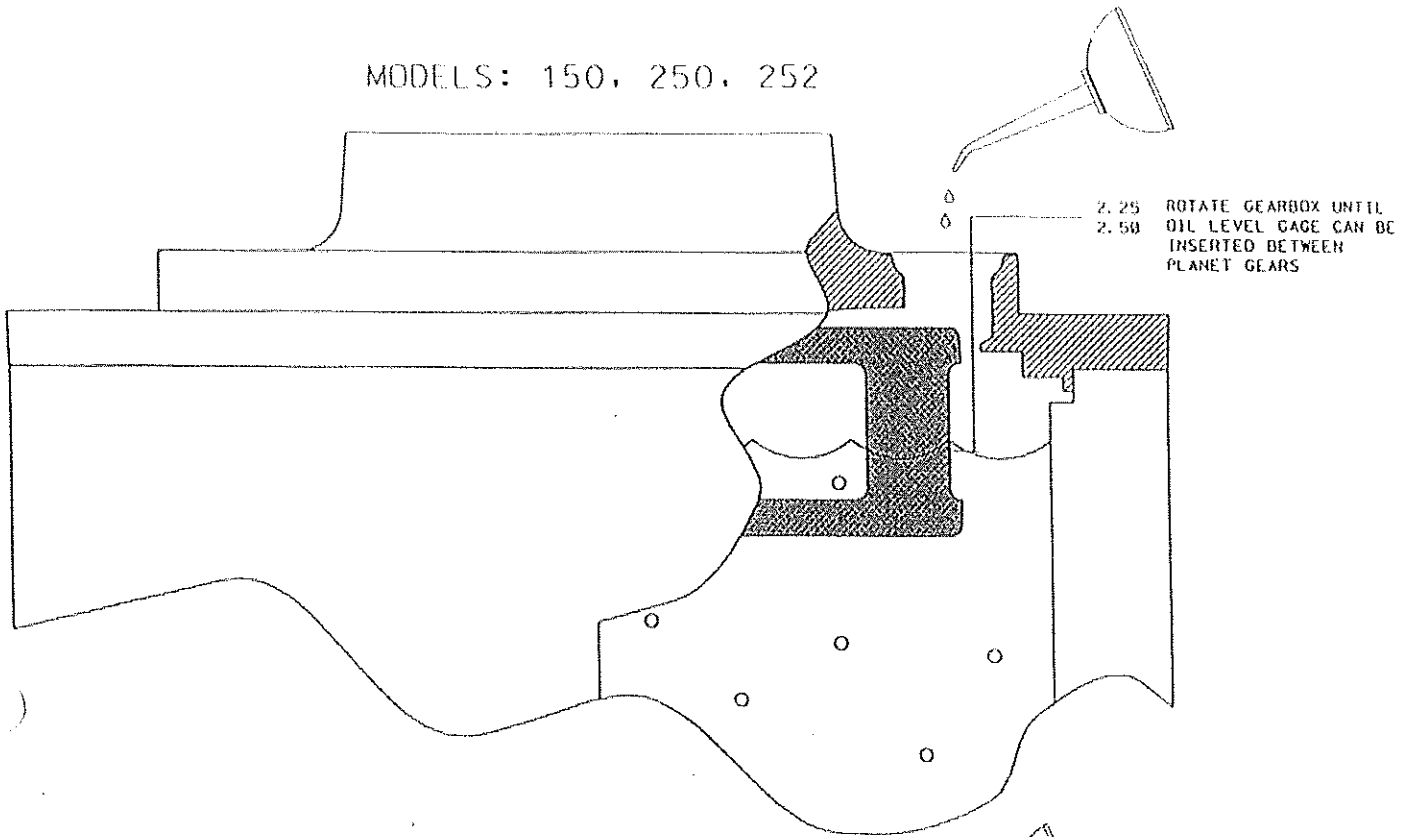
WARNING



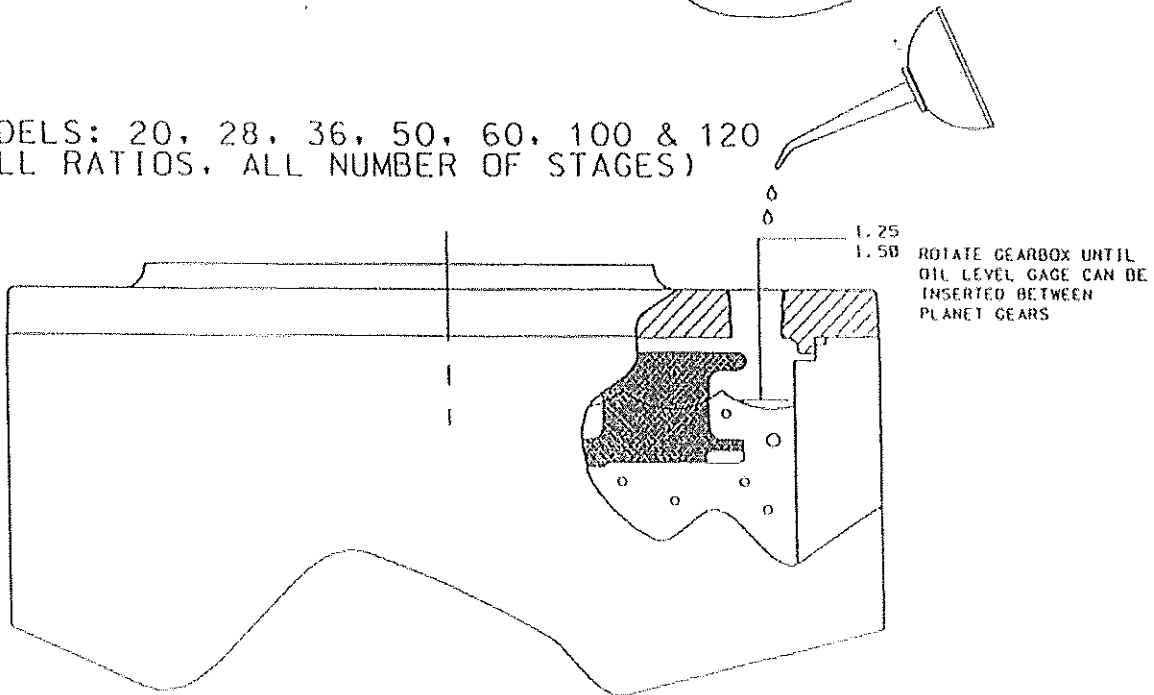
Failure to use the proper type and viscosity of planetary gear oil could result in property damage, severe personal injury, or death.

OIL FILL AND LEVEL CHECK
FOR ESKRIDGE GEARDRIVES
(VERTICAL, PINION DOWN APPLICATIONS)

MODELS: 150, 250, 252



MODELS: 20, 28, 36, 50, 60, 100 & 120
(ALL RATIOS, ALL NUMBER OF STAGES)



BALLRING, PINS, BUSHINGS, SWIVEL

GREASE — General Purpose

Lithium based grease with "EP" additives and rust inhibitors (use Grade #2 for temperatures above 32°F and Grade #1 for temperatures under 32°F.)

ENGINE

FUEL
LUBE OIL } — SEE ENGINE OPERATORS GUIDE

COOLANT

Depends on environmental requirements; complete analysis provided in engine service manual (50% anti-freeze, 50% water normal mix). (See also engine manual.)

SWING BRAKE

Automatic Transmission Fluid — Type F

HYDRAULIC ACTUATORS

HYDRAULIC OIL — Use a quality oil as prescribed for the hydraulic system.

HYDRAULIC LUFFING CYLINDERS

WAX — Car Was (Turtle Wax is recommended)
Was cylinder rods once a month to get longer life out of your cylinder.

FOR PERSONNEL HANDLING

Check oil level in winches every 2 weeks and brake test every quarter. Disassemble and inspect all wear parts annually.

WIRE ROPE

Esgard

HOSE LIST

HOSE LIST

ITEM	QTY	HOSE ID (IN)	PART NUMBER	LOCATION TO	LOCATION FROM
1	1	1"	N7B4216-300	Auxiliary Control Valve (Inlet)	Hydraulic Pump #1
2	1	¼"	N7B4204-130	Auxiliary Pressure Gauge	Auxiliary Control Valve (Inlet)
3	1	1-1/4"	N76120-290	Return Manifold	Auxiliary Control Valve (Outlet)
4	1	1"	N7B4216-620	Auxiliary Hoist (Down)	Auxiliary Control Valve (down)
5	1	1"	N7B4216-240	Auxiliary Dump Valve (in)	Auxiliary Control Valve (Up)
6	1	1"	N7B4216-710	Auxiliary Hoist (Up)	Auxiliary Dump Valve (out)
7	1	1"	N7B4216-100	Main control valve (inlet tee)	Auxiliary control valve power beyond (check)
8	1	1 ¼"	N7A1120-340	Boom control valve (inlet)	Pump #2
9	1	¼"	N7B4204-170	Boom pressure gauge	Boom control valve (inlet)
10	1	1 ½"	N76124-290	Return manifold	Boom control valve (outlet)
11	1	¾"	N76512-260	Boom cylinder up left	Boom control valve up
12	1	¾"	N76512-210	Boom cylinder up right	Boom control valve up
13	1	¾"	N76512-270	Boom cylinder down left	Boom control valve down
14	1	¾"	N76512-220	Boom cylinder down right	Boom control valve down
15	2	¼"	N7B4204-036	Counter balance valves	Boom cylinder down port
16	1	1"	N7B4216-340	Main hoist control valve (inlet tee)	Pump #3

HOSE LIST

ITEM	QTY	HOSE ID (IN)	PART NUMBER	LOCATION TO	LOCATION FROM
17	1	¼"	N7B4204-130	Main pressure gauge	Main control valve (inlet)
18	1	1 ½"	N76124-230	Return manifold	Main control valve (outlet)
19	1	1 ½"	N7A1124-620	Main hoist down	Main control valve down
20	1	1 ½"	N7A1124-210	Main dump (in)	Main control valve (up)
21	1	1 ½"	N7A1124-560	Main hoist (up)	Main dump valve (out)
22	1	¾"	N76412-300	Swing control valve (inlet)	Pump #4
23	1	¼"	N7B4204-120	Swing pressure gauge	Swing control valve (inlet)
24	1	1"	N76116-210	Return manifold	Swing control valve (outlet)
25	2	¾"	N76412-340	Swing drive	Swing control valve
26	1	¼"	N7B4204-340	Park brake	Swing control valve (1/4" check-inlet tee)
27	1	¼"	N7B4204-120	Park brake valve (in)	Swing control valve (1/4" check-inlet tee)
28	1	¼"	N7B4204-340	Hydraulic tank	Park brake valve (out)
29	1	¼"	N7B4204-350	Dynamic brake	Dynamic brake actuator
30	1	¼"	N7B4204-210	Swing brake cooler	Return manifold (1/4" flow control)
31	1	¼"	N7B4204-330	Hydraulic tank	Swing brake cooler (out)
32	1	½"	N7B4204-090	Aux dump valve (1/2" check tee)	Main dump valve (1/2" check tee)
33	1	½"	N7B4208-260	Anti-2 block override (in)	Aux dump valve (1/2" check-tee)
34	1	½"	N7B4208-280	S/S tubing base pressure	Anti-2 block override valve (out)
35	1	½"	N7B4208-190	Main CBSD valve (in)	S/S tubing tip pressure
36	1	½"	N7B4208-300	Aux CBSD valve (in)	S/S tubing tip pressure
37	1	½"	N7B4208-192	S/S tubing tip return	Main CBSD valve (out)

HOSE LIST

ITEM	QTY	HOSE ID (IN)	PART NUMBER	LOCATION TO	LOCATION FROM
38	1	½"	N7B4208-304	S/S tubing tip return	Aux CBSD valve (out)
39	1	½"	N7B4208-340	Hydraulic tank	S/S tubing base return
40	1	¼"	N7B4204-190	Main case drain (tee)	Aux case drain
41	1	¼"	N7B4204-340	Hydraulic tank	Main case drain (tee)
42	1	¼"	N7B4204-320	Return pressure gauge	Return manifold
43	1	3"	N7A7548-190	Return filter	Return manifold
44	1	¼"	N7B5104-075	Load cell gauge	Load cell
45	1	¼"	N7B4204-480	Engine oil pressure gauge	Engine block
46	1	1"	N76116-220	Air swivel (bottom)	Pedestal wall
47	1	1"	N76116-390	Air tank (in)	Air swivel (top check)
48	1	1"	N76116-160	Air relay valve (in)	Air tank (out)
49	1	1"	N76116-400	Air starter	Air relay valve (out)
50	1	¼"	N7B4204-140	Start valve (in-tee)	Air relay valve (in)
51	1	¼"	N7B4204-350	Air pressure gauge	Air start valve (in-tee)
52	1	¼"	N7B4204-350	Air relay valve "APP"	Air start valve (out)
53	1	¼"	N7B4204-420	Air wiper valve (in)	Air tank
54	1	¼"	N7B4204-500	Throttle cylinder	Throttle actuator
55	1	¼"	N7B4204-180	Pressure switch (electric)	Oil pressure gauge
56	1	2 ¼"	N7A5340-088	Pump #1	Hydraulic tank
57	1	2"	N7A5332-088	Pump #2	Hydraulic tank
58	1	2"	N7A5332-088	Pump #3	Hydraulic tank

HOSE LIST

ITEM	QTY	HOSE ID (IN)	PART NUMBER	LOCATION TO	LOCATION FROM
59	1	1 ½"	N7A5324-088	Pump #4	Hydraulic tank
60	1	3/8"	N7806-110	Fuel pump	Fuel tank
61	1	3/8"	N78106-140	Sentinel (in)	Fuel filter
62	1	3/8"	N78106-140	Fuel rack (in)	Sentinel (out)
63	1	5/16"	N78105-120	Fuel tank	Fuel rack (out)
64	1	¼"	N7B4204-130	Sentinel (in)	Engine oil pressure
65	1	¼"	N7B4204-120	Water temp probe (tee-in)	Sentinel (out)
66	1	¼"	N7B4204-140	Oil temp probe (tee)	Water temp probe (tee-in)
67	1	¼"	N7B4204-140	Water temp probe (vent-in)	Oil temp probe (vent)
68	1	¼"	N7B4204-120	Engine block	Water temp probe (vent-tee)
69	-	-	-	-	-
70	-	-	-	-	-
71	-	-	-	-	-
72	-	-	-	-	-

ENGINE & REPLACEMENT PART LIST

ENGINE & REPLACEMENT PARTS
S.W. PETROLEUM SERVICES, INC. / PEMEX
CRANE LOCATION: CIUDAD DEL CARMEN
MODEL NUMBER: 180B-60
SERIAL NUMBER: 020207C

ITEM	QTY.	PART NUMBER	DESCRIPTION
1	1	N46996-005	Engine
2	1	N46996-533	Radiator and Cap
3	1	N46996-503	Radiator Fan Guard
4	1	N46996-504	Radiator Shroud
5	1	N46996-510	Primary Fuel Filter
6	1	N46996-511	Secondary Fuel Filter
7	1	N46996-512	Oil Filter
8	1	N46996-550	Air Cleaner Assembly
9	1	N46996-551	Engine Fan Belt
10	1	N46996-518	Fan Pulley System
11	1	N46996-552	Belt Tensioner
12	1	N46996-520	Flywheel
13	1	N46996-535	Water Pump
14	1	N46996-522	Fan Blade
15	1	N46996-523	Upper Radiator Hose
16	1	N46996-553	Lower Radiator Hose

HYDRAULIC SYSTEM



SEE MAINTENANCE PRECAUTIONS
PRIOR TO PERFORMING ANY WORK.

HYDRAULIC SYSTEM

- PART REPAIR OR REPLACEMENT -

Any repair of hydraulic parts, particularly pumps, motors and cylinders, requiring complete disassembly of the unit is not recommended to be performed in the field.

Major repairs should only be attempted by experienced, qualified and properly equipped personnel. Only minor repairs and adjustments as described in the manual should be performed in the field.

As always, the prime consideration when working on the hydraulic system is to insure that no contamination is introduced into the system.

When replacing a hydraulic part, the following basic outline should be used:

1. Remove damaged part and install new part.
2. If any debris are present in the hoses or tubing, the lines should be flushed clean with a suitable solvent and blown dry before reconnecting.
3. If the hydraulic part is a pump or motor, hand-fill ports with clean hydraulic oil (Provides lubrication for initial start-up).
4. Reconnect all tubing and hoses.
5. If debris from damaged parts are in the system (such as motor which has "gone to pieces"), replace the return line filter element and check the suction strainers.
6. Check all mounting bolts, nuts and/or pins.
7. Start prime mover and allow it to run at low idle (1,000rpm).
8. Operate system at least a few minutes at zero pressure.
9. Operate repaired system without a load on the hook, observing operating pressure and general operational characteristics.
10. Operate system with a load, observing operating pressures and general operational characteristics.
11. Inspect the system for hydraulic leaks and correct any abnormalities.

MAINTENANCE - MALFUNCTION DIAGNOSIS

The following chart list malfunctions which may occur during equipment operation, followed immediately by the possible cause and solution. These are not all inclusive but are designed to help isolate the problem.

CONDITION	POSSIBLE CAUSE	POSSIBLE SOLUTION
<i>No response to control</i>	Load too heavy	Check Capacity Chart
	Low hydraulic fluid supply pressure	Check and fill as required
	Broken hydraulic pressure line	Replace as required
	Incorrect relief valve setting	Call OSI* Service
	Relief valve sticking	Call OSI* Service
<i>Poor hydraulic system performance</i>	Low hydraulic supply flow	Call OSI* Service
	Relief valve sticking	Call OSI* Service
	Relief setting too low	Call OSI* Service
	Boom holding valves out of adjustment	Warm oil or use less viscous oil
	Lines restricted	Check lines; clean and repair as necessary
	Internal valve crack	Replace valve
	Load too heavy	Check Capacity Chart and reduce load
<i>Swing moves erratic or loosely</i>	Loose turntable bearing	Torque bearing mounting and call OSI* Service
	Loose swing gearbox mounting bolts	Tighten bolts
	Worn gears or bearing	Replace worn parts or adjust gearbox spacing
	Operator control of lever too erratic	Operate controls smoothly
	Brake not releasing	Check pressure in brake release line

The following chart list malfunctions which may occur during equipment operation, followed immediately by the possible cause and solution. These are not all inclusive but are designed to help isolate the problem.

CONDITION	POSSIBLE CAUSE	POSSIBLE SOLUTION
<i>Swing will not turn</i>	Attempting to swing up too much on incline	Level machine
	Turn circuit relief valves sticking	Clean and check circuit pressure
	Turntable bearing drag	Lubricate thoroughly as rotating boom
	Brake not releasing	Use bleed screw on brake to remove air
<i>Excessive noise during operation</i>	Low oil temperature	Allow unit to warm up
	Low hydraulic oil supply	Check and fill
	Suction line kinked, collapsed or blocked	Clear blockage
	Hydraulic oil too thick	Warm oil use oil more applicable to environment
	Plugged suction strainers	Remove from tank and clean
	Relief valve chatting	Dirt in relief valve or damaged relief
	Swing brake dragging	Use bleed screw on brake to remove air
	Hydraulic tubing vibration	Check for loose tubing
<i>Cylinders drift loosely</i>	Tank breather plugged	Clean breather
	Not getting oil to cylinders	Clean and replace as required
	Worn or damaged piston seals	Replace as required
	Air in hydraulic oil	Cylinder operate crane cylinder to remove air
	Loose holding valve	Tighten valve
	Dirt in holding or check valve	Clean valve

The following chart list malfunctions which may occur during equipment operation, followed immediately by the possible cause and solution. These are not all inclusive but are designed to help isolate the problem.

CONDITION	POSSIBLE CAUSE	POSSIBLE SOLUTION
<i>Winch will not lift or hold load</i>	Load too heavy.	Check load and change to applicable multipart reeving
	Relief valve setting too low	Check and adjust if required
	Motor worn excessive.	Replace motor
	Counterbalance valve defective or leaking	Clean and replace as necessary
	Brake worn out	Repair or replace brake
** Boom chatters during extension or retraction or does not sequence	Boom section needs lubrication.	Grease boom
	Worn wear pads	Replace pads
	Locks inoperative	Clean and grease dirty locks or replace worn/broken parts
	Worn locks	Remove burrs or slightly worn areas with a file. Replace if major wear is evident
*** Boom winch chatters	Ratchet and pawl not releasing	Adjust

* OSI Service (985)851-5600

** If Telescopic Crane Only

*** If Lattice Boom Crane Only

MANUFACTURER HOIST DATA

BRADEN Gearmatic

Inspection, Testing, Preventive Maintenance and Special Operating Instructions For Planetary Hoists

⚠ WARNING ⚠

Read and understand these entire instructions BEFORE operating or servicing your BRADEN/Gearmatic hoist. Retain these instructions for future reference. Failure to properly operate, maintain and service a hoist may lead to loss of load control and result in property damage, serious injury or death.

→ **NOTE:** This publication replaces PA125A dated 6/99.
This publication also replaces Braden Part No. 25672. ←

Periodic Inspections	Pages 1 – 2	Brake Test Procedure	5
Inspection Records & Retention	2	Emergency Lowering Procedure	6
Oil Sampling & Analysis	4	Personnel Handling	7

These instructions apply to the following planetary hoists:

PD5/GH5/BG6 (any design series)	CH150A, CH175A, CH185A, CH210
PD7/BG8 (any design series, Equal Speed only)	CH230A, CH240A, CH330A, CH400A
PD12 (any design series)	CH500A, CH600A, CH640, CH940
PD15B ("B" design series only)	CH22B ("B" design series only)
	GH30, GH50 (with external motor & brake valve)

Inspection, testing and preventive maintenance requirements are divided into several categories: Pre-use, Quarterly, Semiannual and Annual as outlined below. The Installation, Maintenance and Service Manual for each model provides specific instructions for maintenance and service.

Some inspection intervals make reference to hoists used in "Severe Duty Applications". Severe Duty Applications are where the hoist is operated more than 12 hours per day and/or for extended periods of time at or near the rated capacity of the hoist.

Anytime that the hoist exhibits erratic operation and/or unusual noise(s), the hoist should be taken out of service until it is inspected and serviced by a qualified technician.

REGULAR INSPECTION, TESTING & PREVENTIVE MAINTENANCE - Must include, but not be limited to the following:

PRE-USE INSPECTION (each shift the hoist is used): Will be performed prior to placing the crane into service and then as necessary during the day for extended operation.

1. Check for external oil leaks and repair as necessary. **This is extremely important due to the accelerated wear that can be caused by insufficient lubricating oil in the hoist.** Lubricant level must be maintained between the maximum and minimum levels. Use only the recommended type of lubricant; see service manual for details. On models without a sight glass, check oil level monthly.
2. Check the ratchet and pawl mechanism (if so equipped) for proper operation and for full engagement of the pawl with the ratchet wheel. Repair and/or adjust as necessary.
3. Check hydraulic plumbing for damage, such as chafed or deteriorated hoses, and repair as necessary.
4. Visually inspect for loose or missing bolts, pins, keepers or cotter pins and replace or tighten as necessary.

QUARTERLY INSPECTION (every 3 months) or monthly in Severe Duty Applications or prior to putting the machine into service if it has not been used for 3 months or more. Documentation of the inspections must be kept with the hoist/crane for a minimum of two (2) years from the date of the inspection (see page 3).

Perform the **PRE-USE INSPECTION** plus the following:

1. Check the lubricant level in the hoist(s) and maintain it between maximum and minimum levels. Use only recommended type of lubricant; see service manual for details.
2. On hoists used for personnel handling, the internal spring-applied brake shall be tested in accordance with the procedure on page 5 of these instructions.
3. Inspect for corrosion of fasteners, mounting base, drum, etc. and repair/replace as necessary.

SEMI-ANNUAL INSPECTION (every 6 months), or quarterly in Severe Duty Applications.

Documentation of the inspections must be kept with the hoist/crane for a minimum of two (2) years from the date of the inspection (see page 3).

Perform the **PRE-USE INSPECTION** and **QUARTERLY INSPECTION** plus the following:

Take a sample of the lubricating oil from the hoist drum, following the oil sampling procedure on page 4, and analyze it for wear metals content, the correct viscosity, signs of overheating, water and other contaminants. If the oil sample contains an unusual amount of metallic particles (reference oil sample procedure on page 4), the hoist should be taken out of service and undergo a tear down inspection. The oil sample must be taken prior to changing the lubricating oil. The Semi-annual oil analysis can be omitted if the crane has been used less than 250 hours since the previous oil sample.

ANNUAL INSPECTION, Testing & Preventive Maintenance or Semi-annually in Severe Duty Applications. Documentation of the inspections must be kept with the hoist/crane for a minimum of two (2) years from the date of the inspection (see page 3). The Annual Inspection must include, but not be limited to the following:

1. Perform the **PRE-USE INSPECTION**, **QUARTERLY** and **SEMIANNUAL INSPECTIONS**, plus the following:
2. Change lubricating oil in hoist drum after oil sample is taken. Consult the service manual for the recommended lubricant. Failure to follow these recommendations may result in brake failure.

i ***NOTE: If the oil sampling/analysis has not been performed as required, refer to the tear down inspection section on page 3.***

The user of BRADEN products is responsible for hoist inspection, testing and maintenance noted above with frequency dependent upon the severity of the hoist duty cycle and the thoroughness of the preventive maintenance program in effect.

Alternate inspection periods may be used if approved in writing by BRADEN. Those that are interested in an alternate inspection period should submit a written proposal to BRADEN that includes typical duty cycle for the hoist along with a detailed description of the preventive maintenance program for these hoists.

Inspection Records & Retention

Crane inspection reports as well as records of preventive maintenance, repairs and modifications to hoists should be available and accessible for a minimum of two years. These records should include, but not be limited to, hoist model and serial number, name and employer of repair/inspection technician, date and description of preventive maintenance, functional test reports and repairs.

To provide customers with qualified outlets for hoist service and repairs, BRADEN has established authorized Service Centers. These Service Centers have factory trained service technicians, up-to-date service information, extensive parts inventories, complete testing facilities, and are audited by BRADEN on a regular basis for compliance. **BRADEN strongly recommends the use of BRADEN authorized Service Centers** for maintenance, repair and inspection of BRADEN/Gearmatic products. Contact the Braden Product Support Department at 918-251-8511 for the names of current authorized Service Centers.

TEAR DOWN INSPECTION – Any Hoist that has NOT been subject to regular oil sample analysis should undergo a tear down inspection on an annual (12 month) basis. Also, if a hoist has an unknown history of repair and/or maintenance, it is recommended that the hoist undergo a tear down inspection prior to it being placed into service.

A tear down inspection should include the hoist being completely disassembled, cleaned and inspected and replacement of all worn, cracked, corroded or distorted parts such as pins, bearings, shafts, gears, brake rotors, brake plates, drum and base. Refer to the applicable BRADEN or Gearmatic Service Manual for more details. All seals and o-rings should be replaced during a tear down inspection.

Any deficiencies, such as those listed above shall be corrected immediately.

All of the following operations must be performed before the hoist is placed back in service:

The rebuilt hoist must be line pull tested to the rated load of the hoist (hoist rating will vary with motor, gear ratio and drum options) with a dynamometer or equivalent measuring device. This test load should be the maximum rating for the hoist for the specific application (at the normal hydraulic relief valve setting for the hoist), not the reduced rating for personnel lifting.

The hoist must be dynamically tested by rotating the drum several times, in both the hoisting and lowering directions, while under a load of at least 30% of the hoist lifting capacity. Check for smooth operation during this procedure.

The brake should be tested per the brake test procedures on page 5.

After inspection or rebuild and testing, a new certificate for personnel handling will be issued by the inspector/ service technician effective on the date the hoist is placed back in service.

Name of Service Company	
Approved by BRADEN for handling personnel if used and maintained in accordance with BRADEN Recommendations For Personnel Handling Hoists	
Hoist Model No.:	_____
Hoist Serial No.:	_____
Date of Inspection:	_____
Work Order/Job No.:	_____
Inspector's Name:	_____
For a copy of recommendations call or write: BRADEN PO Box 547, Broken Arrow, OK, 74012, USA (918) 251-8511	

Sample inspection certificate

PREVENTIVE MAINTENANCE AND OIL SAMPLE ANALYSIS RECOMMENDATIONS

Oil Change

The gear oil should be changed after the first 100 hours of operation and on an annual basis, at minimum, thereafter. In severe duty applications, the gear oil should be changed every six months. Use only the recommended type of lubricants; see service manual for details.

Oil Sampling and Analysis

Proper oil sampling and analysis of the sample, is a vital part of a comprehensive preventive maintenance program. Information obtained from the oil analysis is best utilized in conjunction with a regular program of preventive maintenance. The early warning of abnormal wear provided by an analysis program allows the user to substitute preventive maintenance for a far more costly and dangerous failure that may lead to loss of load control that could result in property damage, personal injury or death. Early detection of accelerated component wear allows the scheduling of corrective maintenance and can reduce in-operation failures and costly down time.

Taking A Valid Oil Sample

Prepare the hoist by cleaning the drain area and drain extension tube in order to obtain an uncontaminated sample. Operate the hoist in both directions for one to two minutes and then take the oil sample from the drain port as soon as possible. Do not take the sample from the first oil out the drain port. Take a sample from the mid-stream flow of the oil to obtain an accurate representation of the oil condition. After taking an oil sample, check the oil level and add new oil as required. Refer to the applicable Braden service manual for recommended lubricant.

WARNING

Hot oil may cause personal injury and/or burns to unprotected skin. Make certain the oil has cooled to a safe temperature (less than 110° F or 43° C) before taking an oil sample, changing oil or servicing the winch.

Analysis

General Guide Lines

(After approximately 250 hours of operation)

Iron Contaminates

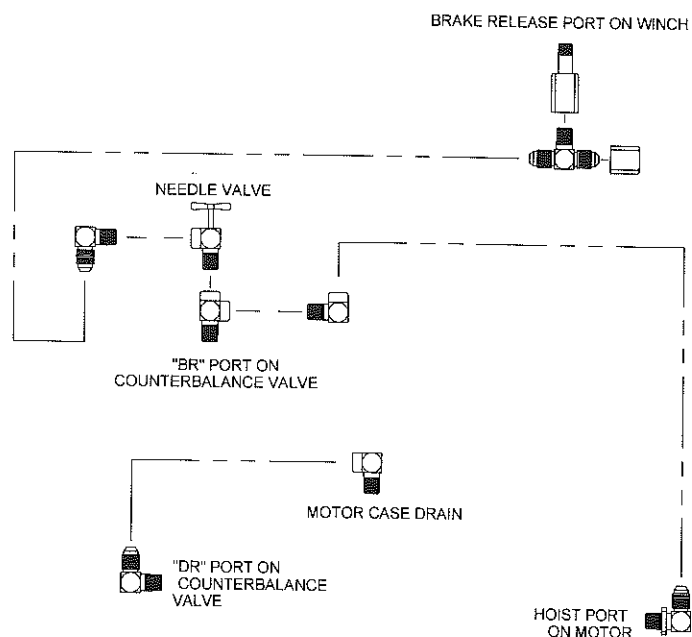
100 to 500 ppm	Normal
501 to 800 ppm	Caution - Abnormal Sample (monitor on a more frequent time line)
801 ppm & up	Unacceptable - Abnormal Sample (further investigation required, tear down inspection recommended)

In all contaminate monitoring, equally important as the level of contamination, is the change in the amount of contamination compared to previous samples.

BRAKE TEST PROCEDURE FOR BRADEN/Gearmatic HOISTS

All BRADEN planetary hoists have a spring applied, hydraulically released, multiple disc brake inside the hoist housing (Gearmatic hoists have a large single brake disc). This brake holds a suspended load when the directional control valve is in neutral, or when hydraulic power is lost. A brake clutch assembly permits the power train and drum to rotate in the direction to lift a load, while the brake remains fully applied. A load cannot be lowered, however, without applying hydraulic pressure to the release port and releasing the brake.

Hoists ordered for personnel handling cranes will have a needle valve in the brake release line. They will also have a tee in the brake release line between the needle valve and the brake release port on the hoist. One opening in the tee is capped. With the valve closed and the cap removed from the tee, the brake is isolated from system pressure and vented to atmosphere. The brake cannot be released under these conditions by actuating the directional control valve.



Relative location of needle valve to other components and fittings on the winch, motor and counterbalance valve.

One purpose of the valve/tee combination is to provide a means to test the brake; the other is to provide a means to lower a load when hydraulic power is lost.

Brake Test Procedure (Hoists Equipped With Brake Valves) - Test to be performed with minimal load on the hoist.

Remove the lockwire on the valve handle and close the valve tightly.

Remove the plug in the tee (in the brake release circuit).

With the hydraulic power unit running, move the directional control valve handle slowly to the full open, lowering position.

Increase the engine speed, if necessary, to bring system pressure up to the relief valve setting. The hoist drum should remain stationary.

If the drum rotates, the hoist should be disassembled and the brake should be examined for wear. In addition, the brake springs should be measured for correct free length in those hoists using helical compression springs.

Replace any parts showing excessive wear, and any spring whose length is shorter than the minimum shown in the hoist Service Manual.

Reassemble the brake and hoist and repeat the above steps.

When testing is complete, be sure to reinstall the plug in the tee, fully open the valve and replace the lockwire.

The above procedure utilizes the hoist hydraulic motor to test the brake's ability to resist approximately 115% of the rated hoist load.

EMERGENCY LOWERING PROCEDURES

1. Remove the lockwire on the needle valve handle and close the valve tightly.

The following procedure releases the multiple disc brake while leaving the brake valve closed. Since gear type motors are not zero leakage devices, internal motor leakage permits the load to slowly rotate the motor although its outlet is blocked by the closed brake valve. This procedure will **NOT** work if there is little or no oil in the motor. Using properly rated pipe and fittings the standpipe described below may be permanently installed in the hydraulic system to avoid installing one in an emergency.

WARNING

The standpipe referred to in step (3) below **MUST** be used. Attempting this procedure with no oil in the motor or with the brake valve stuck in the open position will cause the load to free fall, which could result in property damage, personal injury or death.

2. Remove the plug in the tee.
3. Remove both main hoses from the motor and attach a standpipe to the motor port on the opposite side of the motor from the brake valve. **NOTE:** This port may be fitted with a manifold. The standpipe is simply a length of pipe (approximately 12 inches (305 mm) long) attached to a 90° elbow. The other end of the elbow is attached to a short nipple and fitting suitable for mounting to the motor port or manifold. The standpipe is installed with the standpipe pointing up in a vertical position. While the load is being lowered, oil **MUST** be added to the standpipe as necessary to prevent the motor from running dry.
4. Fill the standpipe with hydraulic oil, making certain that oil is not running out of the brake valve. If oil is running out of the brake valve, stop the emergency lowering procedure. Remove the spring retainer and tap the main spool of the brake valve to the closed position. Replace the spring retainer. After completing the emergency lowering procedure, the brake valve **MUST** be serviced and repaired if the spool was stuck.
5. Connect a hand pump to the opening in the tee.

WARNING

Do not touch the motor, brake valve or standpipe while lowering a load. They may become hot enough to cause burns.

6. Operate the hand pump up to about 1,000 psi (6,900 kPa). A suspended load will slowly come down. Releasing the pressure on the hand pump will cause the load to stop. If a chattering noise is heard while the load is coming down, pump the hand pump to a higher pressure until the noise stops. Do not exceed 1,500 psi (10,350kPa) to the brake release port.
7. **Always** inspect the brake plates for signs of overheating and replace if necessary following this procedure. Refer to the applicable Braden or Gearmatic service manual for details.
8. If this procedure was performed due to a malfunction of the hoist, remove the hoist from service and perform a teardown and inspection to correct the cause of the malfunction before returning the hoist to service.

PERSONNEL HANDLING

BRADEN recognizes that most hoists and cranes are designed and intended for handling materials and not personnel. **The crane or hoist is only to be used to handle personnel if it can be shown there is no less hazardous way of carrying out the job.** In these situations, all safety precautions must be strictly adhered to. BRADEN recommends adherence to the latest revision of API 2D (RP 2D) and/or ANSI/ASME standard B30.5 and/or OSHA and/or other applicable standards for your application. It is important that you obtain a copy of all applicable safety standards, and that you read and understand them prior to using the hoist. **In addition to**, or in conjunction with, the applicable standards, BRADEN requires *:

- The hoist must be maintained in accordance with the recommendations in this document and the service procedures in the Installation, Maintenance and Service Manual for your specific hoist.
- When handling personnel, the allowable line pull will be limited to 30% of the hoist rated line pull. This reduction increases the hoist design factor from 3:1 to 10:1, approximately. Example: a hoist rated at 15,000 lbs. on the first layer will be rated at $15,000 \times 0.3 = 4,500$ lbs. on the first layer when handling personnel.
- Personnel are only permitted to ride in an approved personnel platform as described in API, OSHA or ANSI/ASME standards.
- The crane must be in good working order and equipped with all required safety equipment, including an anti two-blocking device or warning signal and a boom angle and length indicator. Two-blocking occurs when the load block or hook assembly comes in contact with the upper block or point sheave assembly and often results in damage to the wire rope, rigging and/or hoist.
- Personnel being lifted or supported shall wear safety belts with lanyards attached to designated points unless lifting over water. If lifting over water, provide approved personal flotation devices (PFD's).
- The lifting and supporting shall be made under controlled conditions and under the direction of an appointed signal person.
- The operator and signal person shall conduct a test lift, without personnel in the personnel platform, to verify adequacy of the crane footing or support. The crane outriggers, if so equipped, must be fully extended and properly set.
- Cranes shall not travel (move locations) while personnel are on the personnel platform.
- The platform must be landed or tied off, and all brakes set before personnel enters or exits.

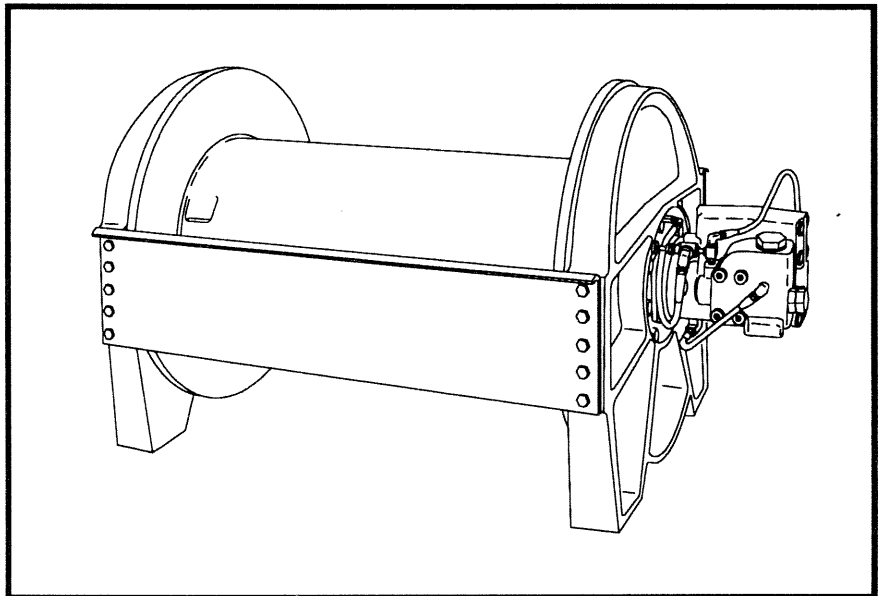
* If there are any questions, concerns, or conflicts with other safety standards, call or write the BRADEN Product Support Department, PO Box 547, Broken Arrow, OK, 74012, USA, Telephone (918) 251-8511
Additional information can be obtained from the following organizations:

- Booklet on "Hoisting Personnel", Crane Institute of America Inc., 1063 Maitland Center Commons, Suite 100, Maitland, Florida, 32751 USA (800) 832-2726
- OSHA Standard 29 CFR 1926.550 - Cranes, Derricks, Hoists, Elevators, and Conveyors, Occupational Safety and Health Administration (OSHA), 200 Constitution Ave. N.W., Washington D.C. 20210 USA (202) 219-4667
- ANSI/ASME Standard B30.5, American National Standards Institute (ANSI), 11 W. 42nd Street, New York, New York 10036 USA (212) 642-4900
- API Specification RP 2D, American Petroleum Institute (API) 1220 L Street, N.W., Washington, DC 20005 USA (202) 682-8375

BRADEN

2ND GENERATION “CH” SERIES PLANETARY HOISTS

CH150A
CH175A
CH185A
CH230A
C2H150A
C2H175A
C2H185A
C2H230A



INSTALLATION, MAINTENANCE AND SERVICE MANUAL

PACCAR WINCH DIVISIONS

TABLE OF CONTENTS

FOREWORD	2
GENERAL SAFETY RECOMMENDATIONS	3
BASIC OPERATION	4
HOIST INSTALLATION	6
WIRE ROPE INSTALLATION	6
WIRE ROPE WEDGES	7
HYDRAULIC CIRCUITS	8
RECOMMENDED BOLT TORQUES	8
PREVENTIVE MAINTENANCE	9
RECOMMENDED GEAR OIL	10
TROUBLE SHOOTING	11
HOIST DISASSEMBLY	15
EXPLODED VIEW DRAWING AND PARTS KEY	18
BRAKE CYLINDER SERVICE AND ASSEMBLY	21
BRAKE CYLINDER TESTING	23
PLANET CARRIER SERVICE AND ASSEMBLY	24
BRAKE CLUTCH SERVICE	27
HOIST ASSEMBLY	29
REVERSING DIRECTION OF DRUM ROTATION	34
BRAKE VALVE SERVICE	36
METRIC CONVERSIONS	39

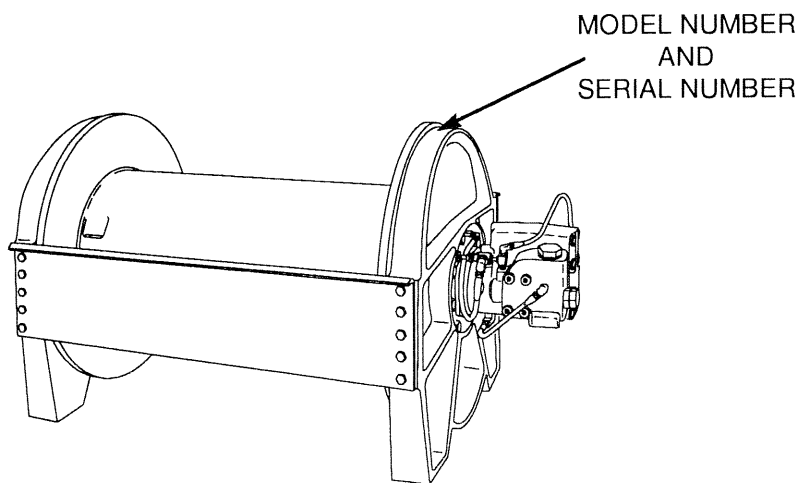
FOREWORD

Read this entire publication and retain it for future reference.

The following service instructions have been prepared to provide assembly, disassembly and maintenance information for the BRADEN Model CH series winch. It is suggested that before doing any work on these units, all assembly and disassembly instructions should be read and understood.

Some pictures in this manual may show details or attachments that are different from your winch. Also, some components have been removed for illustrative purposes.

Continuing product improvement may cause changes in your winch, which are not included in this manual. Whenever a question arises regarding your BRADEN Winch or this manual, please contact BRADEN Service Department at 1-918-251-8511, 08:00 - 16:30 hours, CST, Monday through Friday, for the latest available information.



MODEL NUMBER AND SERIAL NUMBER

When information on a hoist is needed, always refer to the model number and serial number. Both are located on the top of the motor side end plate as indicated above.

EXPLANATION OF MODEL NUMBER

CH **150** **A** - **23** **090** **01** **G** - **1**
| | | | | | | |
CONSTRUCTION MAX DESIGN GEAR MOTOR DRUM DRUM OPTION
HOIST RATING MODEL RATIO SIZE SIZE OPTION

CH	DESIGNATES CONSTRUCTION HOIST (C2H DESIGNATES TWO SPEED)
150	DESIGNATES 15,000 LB FIRST LAYER LINE PULL
A	DESIGNATES THE MODEL SERIES RELATING TO DESIGN CHANGES
23	DESIGNATES TOTAL GEAR REDUCTION
090	DESIGNATES HYDRAULIC MOTOR DISPLACEMENT IN CU IN/REV (DECIMAL POINT ELIMINATED EXAMPLE 090 – 9.0 CU IN/REV)
01	DESIGNATES THE DRUM OPTION
G	DESIGNATES OTHER DRUM OPTIONS (G = GROOVED; M = MACHINED; P = RATCHET AND PAWL; U = UNDERWOUND)
1	PERMITS TESTING AND INSPECTION PRE API2C FOR OFFSHORE CRANES

GENERAL SAFETY RECOMMENDATIONS

1. Be certain equipment (boom, sheave blocks, pendants, etc.) is either lowered to the ground or blocked securely before servicing, adjusting, or repairing winch.
2. Be sure personnel are clear of work area BEFORE operating winch.
3. Read all warning and caution tag information provided for safe operation and service of winch.
4. Inspect rigging and winch at the beginning of each work shift. Defects should be corrected immediately.
5. Keep equipment in good operating condition. Perform scheduled servicing and adjustments listed in the "Preventive Maintenance" section of this manual.
6. An equipment warm-up procedure is recommended for all start-ups and essential at ambient temperatures below +40°F. Refer to "Warm-up Procedure" listed in the "Preventive Maintenance" section of this manual.
7. Do not exceed the maximum pressure (PSI) or flow (GPM) stated in the winch specifications.
8. Operate winch line speeds to match job conditions.
9. Leather gloves should be used when handling wire rope.
10. Never attempt to handle wire rope when the hook end is not free.
11. When winding wire rope on the winch drum, never attempt to maintain tension by allowing wire rope to slip through hands. Always use "Hand-Over-Hand" technique.
12. Never use wire rope with broken strands. Replace wire rope.
13. Do not weld on any part of the winch.
14. Use recommended hydraulic oil and gear lubricant.
15. Keep hydraulic system clean and free from contamination at all times.
16. Use correct anchor for wire rope and pocket in drum.
17. Do not use knots to secure or attach wire rope.
18. The BRADEN designed wire rope anchors are capable of supporting the rated load when installed properly. For additional safety, ALWAYS maintain a minimum of five (5) wraps of wire rope on the drum.

Safety and informational callouts used in this manual include:

WARNING

WARNING — This emblem is used to warn against hazards and unsafe practice which COULD result in severe personal injury or death if proper procedures are not followed.

CAUTION

CAUTION — This emblem is used to warn against potential or unsafe practices which COULD result in personal injury and product or property damage if proper procedures are not followed.

BASIC OPERATION

DESCRIPTION OF HOIST

The hoist is made up of the following sub-assemblies:

1. Hydraulic motor and brake valve
2. Drum, drum closure, ball bearings and oil seals
3. Support end plate and bearing support
4. Motor end plate and motor adapter
5. Tie plates
6. Brake clutch assembly
7. Brake cylinder assembly and multiple-disc brake parts
8. Primary planetary reducer
9. Secondary planetary reducer
10. Ring gear and adapter

THEORY OF OPERATION

The primary sun gear, being coupled to the hydraulic motor by the inner race of the brake clutch assembly, turns with the motor. As the primary sun gear turns, the primary planet gears, which are meshed with the primary sun gear and ring gear, walk around the stationary ring gear, causing the primary carrier to turn in the same direction as the motor shaft, but at a reduced speed. The primary carrier is meshed with the output sun gear which, therefore, turns in the same direction and at the same speed as the primary carrier. The output sun gear causes the output planet gears to walk around the ring gear, turning the output carrier and drum in the same direction as the primary carrier, but at a further reduced speed.

DUAL BRAKE SYSTEM – DESCRIPTION

The dual brake system consists of a dynamic brake system and a static brake system.

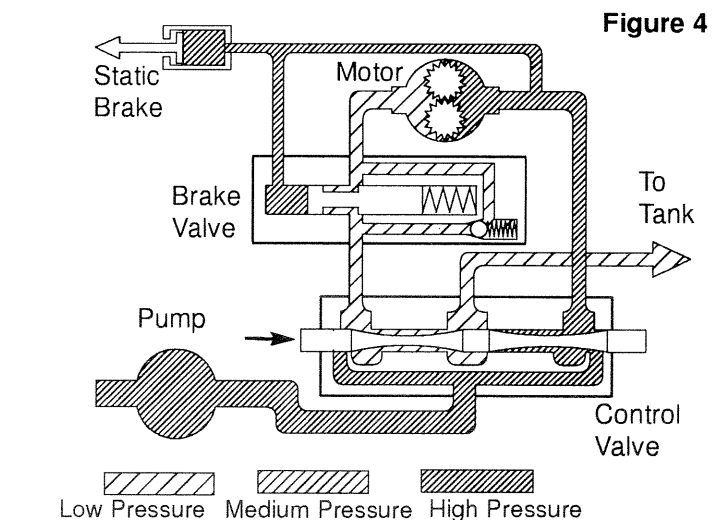
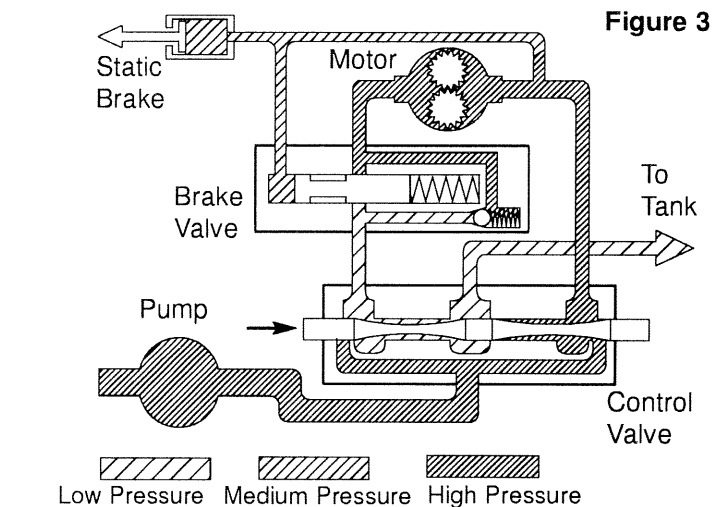
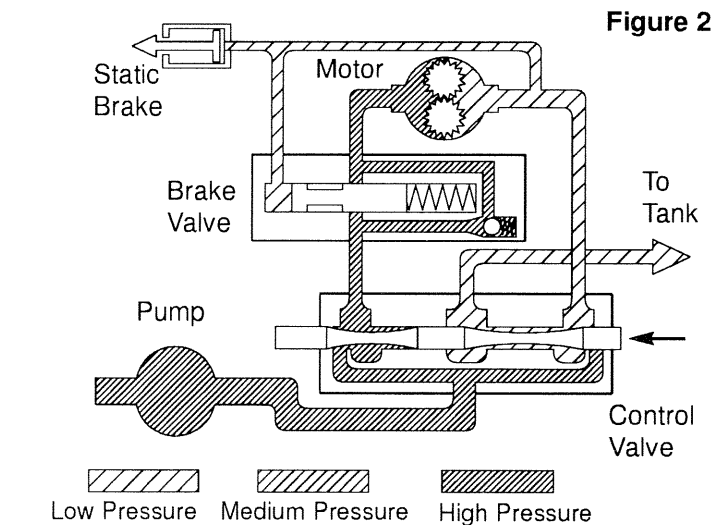
The dynamic brake system has two operating components:

1. Brake valve assembly
2. Hydraulic motor

The brake valve is basically a counterbalance valve. It contains a check valve to allow free flow of oil to the motor in the hoisting direction and a pilot operated, spring-loaded spool valve that blocks the flow of oil out of the motor when the control valve is placed in neutral. When the control valve is placed in the lowering position, the spool valve remains closed until sufficient pilot pressure is applied to the end of the spool to shift it against spring pressure and open a passage. After the spool valve cracks open, the pilot pressure becomes flow-dependent and modulates the spool valve opening which controls the lowering speed. See figures 2, 3 and 4

The static brake system has three operating components:

1. Spring Applied, Multiple Friction Disc Static Brake
2. Brake Clutch Assembly
3. Hydraulic Piston and Cylinder



The static brake is released by the brake valve pilot pressure at a pressure lower than that required to open the pilot operated spool valve. This sequence assures that dynamic braking takes place in the brake valve and that little, if any, heat is absorbed by the friction brake.

The friction brake is a load holding brake only and has nothing to do with dynamic braking or rate of descent of a load.

The brake clutch is splined to the primary sun gear shaft between the motor and the primary sun gear. It will allow this shaft to turn freely in the direction to raise a load and lock up to force the brake discs to turn with the shaft in the direction to lower a load. Figures 5 and 6.

The hydraulic cylinder, when pressurized, will release the spring pressure on the brake discs, allowing the brake discs to turn freely.

DUAL BRAKE SYSTEM — OPERATION

When hoisting a load, the brake clutch which connects the motor shaft to the primary sun gear, allows free rotation. The sprag cams lay over and permit the inner race to turn free of the outer race. Figure 5. The friction brake remains fully engaged. The winch, in raising a load, is not affected by any braking action. Figure 2.

When the lifting operation is stopped, the load attempts to turn the primary sun gear in the opposite direction. This reversed input causes the sprag cams to instantly roll upward and firmly lock the shaft to the fully engaged friction brake. Figure 6.

When the winch is powered in reverse, to lower the load, the motor cannot rotate until sufficient pilot pressure is present to open the brake valve. Figures 3 & 4. The friction brake within the winch will completely release at a pressure lower than that required to open the brake valve. The extent to which the brake valve opens will determine the amount of oil that can flow through it and the speed at which the load will be lowered. Increasing the flow of oil to the winch motor will cause the pressure to rise and the opening in the brake valve to enlarge, speeding up the descent of the load. Decreasing this flow causes the pressure to lower and the opening in the brake valve to decrease thus slowing the descent of the load.

When the control valve is shifted to neutral, the pressure will drop and the brake valve will close, stopping the load. The friction brake will engage and hold the load after the brake valve has closed.

When lowering a load very slowly for precise positioning, no oil flow actually occurs through the winch motor. The pressure will build up to a point where the brake will release sufficiently to allow the load to rotate the motor through its own internal leakage. This feature results in a very slow speed and extremely accurate positioning.

The friction brake receives very little wear in the lowering operation. All of the heat generated by the lowering and stopping of a load is absorbed by the hydraulic oil where it can be readily dissipated.

Figure 5 Static Friction Brake Applied

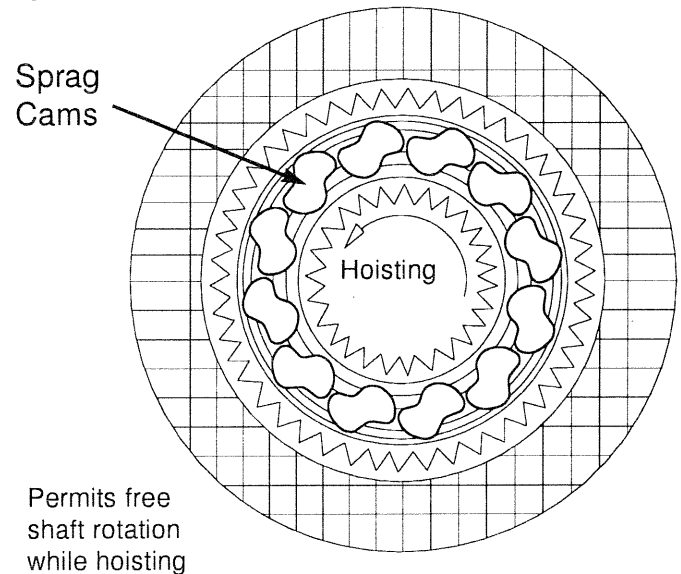
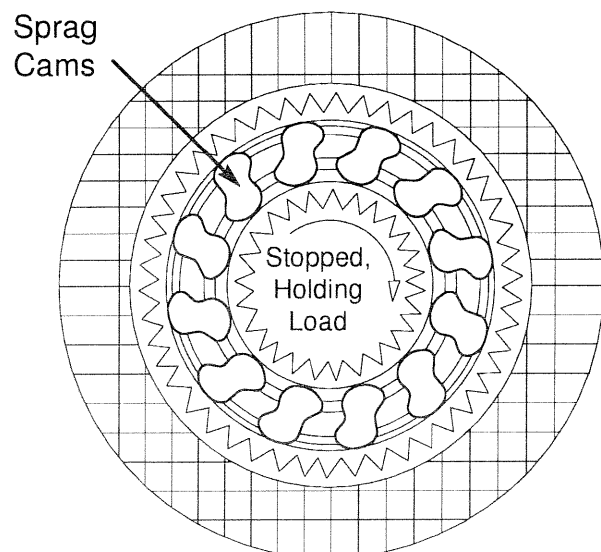


Figure 6 Static Friction Brake Applied



INSTALLATION

GENERAL REQUIREMENTS

1. The hoist should be mounted with the centerline of the drum in a horizontal position. The mounting plane can be rotated to any position around this centerline.
2. When mounting the hoist, use at least grade five bolts and nuts, and use both mounting holes in each end gate.
3. It is important that the hoist be mounted on a surface that will not flex when the hoist is in use, since this could bind the working parts of the hoist. Also, be sure the hoist is mounted on a flat surface. If necessary, use shim stock to insure proper mounting. The mounting surface should be flat within + or -.020 inches.
4. Hydraulic lines and components that operate the hoist should be of sufficient size to assure minimum back pressure at the hoist. The motor manufacturer recommends that the back pressure not exceed 100 psi for maximum motor seal life. 150 psi is the maximum allowable back pressure. The standard CH150A, CH175A, CH185A, CH230A, C2H150A, C2H175A, C2H185A and C2H230A hoists are supplied with the motor internally drained. If high back pressures are encountered, the motor can be drained directly to tank to improve motor seal life. To insure adequate static brake load holding ability, back pressure on the hoist should not exceed 200 psi. For pressures exceeding 200 psi, consult Braden Engineering.
5. Make certain that the hoist drum is centered behind the first sheave and the fleet angle does not exceed 1 ½ degrees. The hoist should also be mounted perpendicular to an imaginary line from the center of the drum to the first sheave to insure even spooling.
6. The hoist directional control valve must be a three-position, four-way valve with a motor spool such that when the valve is in the center position both work ports are opened directly to tank.
7. The hydraulic oil filter should have a 10 micron nominal rating and be a full-flow type.
8. High quality hydraulic oil is essential for satisfactory performance and long hydraulic system component life.

Oil having 150 to 330 SUS viscosity at 100°F (38°C) and viscosity index of 100 or greater will give good results under normal temperature conditions. The use of an oil having a high viscosity index will minimize cold-start trouble and reduce the length of warm-up periods. A high viscosity index will minimize changes in viscosity with corresponding changes in temperature.

Maximum cold weather start-up viscosity should not exceed 5000 SUS with a pour point at least 20°F lower than the minimum temperature.

Under continuous operating conditions the temperature of the oil at any point in the system must not exceed 180°. 120-140°F is generally considered optimum.

In general terms; for continuous operation at ambient temperatures between 50 and 110°F, use SAE 20W; for continuous operation between 10 and 90°F, use SAE 10W; for applications colder than 10°F, contact the BRADEN Service Department. The use of multi-viscosity oils is generally not recommended.

WIRE ROPE INSTALLATION

WARNING

THE CABLE ANCHORS ALONE ON HOISTS ARE NOT DESIGNED TO HOLD RATED LOADS. Winch loads applied directly to the wire rope anchor may cause the wire rope to pull free and result in the sudden loss of load control and cause property damage, personal injury or death. A minimum of 3 wraps of wire rope must be left on the drum barrel to achieve rated load.

The wedge and anchor pocket must be clean and dry. The end of the wire rope being anchored to the drum must be clean and dry and not frayed. Anything on the end of the wire rope to keep it from fraying (i.e. tape or wire) must not be in contact with the wedge when the installation is complete. Consult the wire rope manufacturer on the proper treatment of the dead end of the wire rope. Some rope manufacturers recommend when using rotation resistant wire rope, that the rope end be seized, welded or brazed before inserting the wire rope into the wedge socket to pre-

vent core slippage or loss of rope lay.

Take the free end of the wire rope and insert it through the small opening on the cable drum. Loop the wire rope and push the free end about 3/4 of the way back through the pocket. Install the wedge as shown in figure 7, then pull the slack out of the wire rope. The "dead" end of the rope needs to extend slightly beyond the end of the wedge as shown in figure 8.

Using a hammer and brass drift, drive the wedge as deep into the pocket as possible to ensure it is fully seated and no further movement is detected. Applying a load on the wire rope will also help seat the wedge in the pocket.

Check to ensure the wedge does not protrude from either end of the pocket, causing it to interfere with proper spooling of wire rope onto the drum (see figures 9 & 10). If there is interference or the wedge does not seat firmly, contact the Braden Product Support Department at 918-251-8511 to determine the proper wedge size.

It is important that the wire rope have the proper tensioning when it is installed on the drum. When the wire rope is first installed, you should operate the hoist, with light to moder-

ate loads, with reeving that let's you place these loads on the block and the drum with all the rope off the drum except for the last three wraps.

Correct Installation

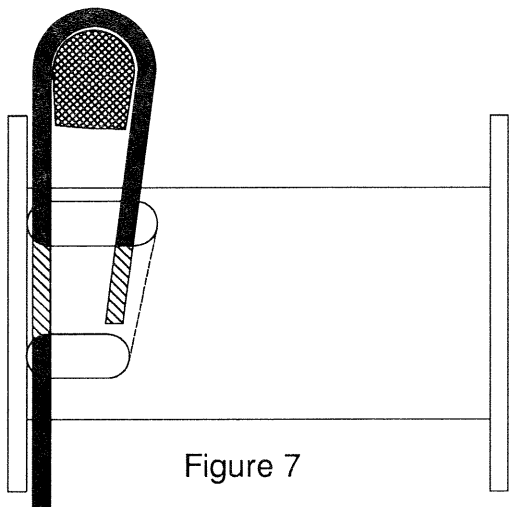


Figure 7

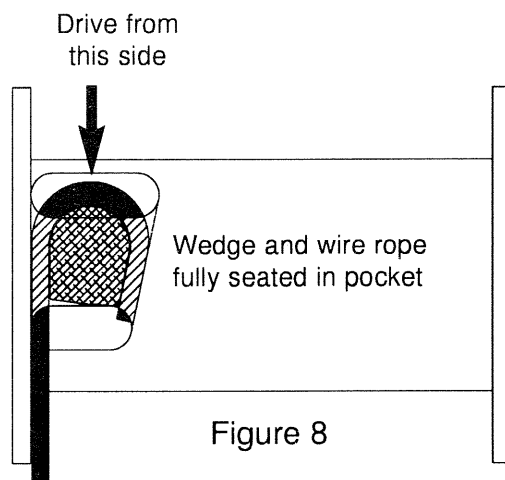
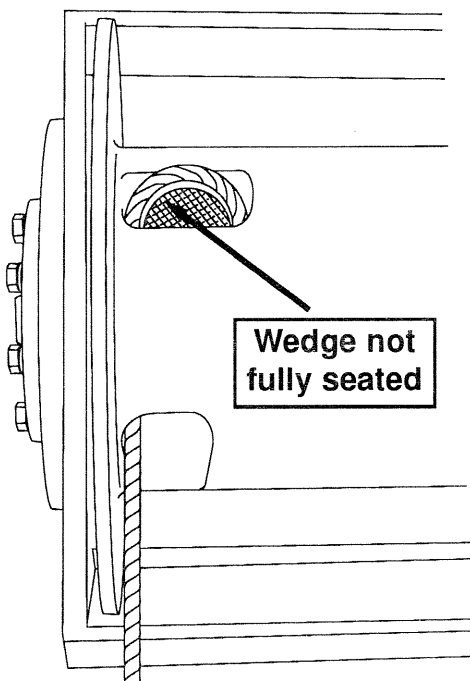


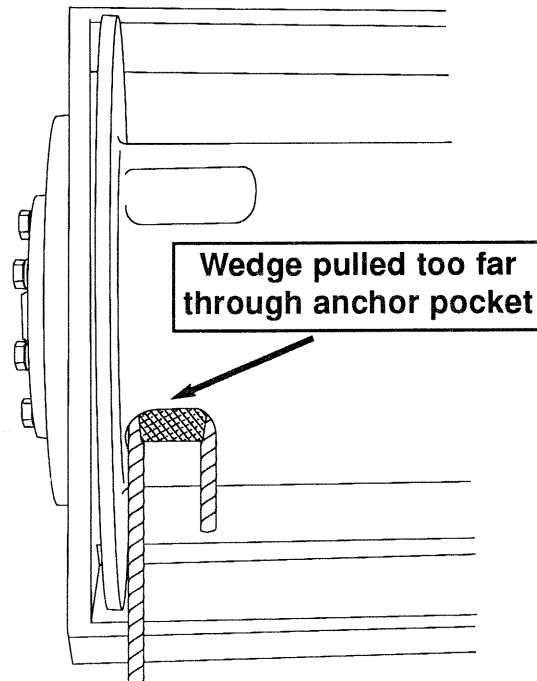
Figure 8

Incorrect Installations



- Wire rope not tight against wedge
- Wedge may be too large

Figure 9



- "Dead" end of wire rope and/or wedge may interfere with proper spooling
- Wedge may be too small

Figure 10

WIRE ROPE WEDGE PART NUMBERS

WINCH MODEL

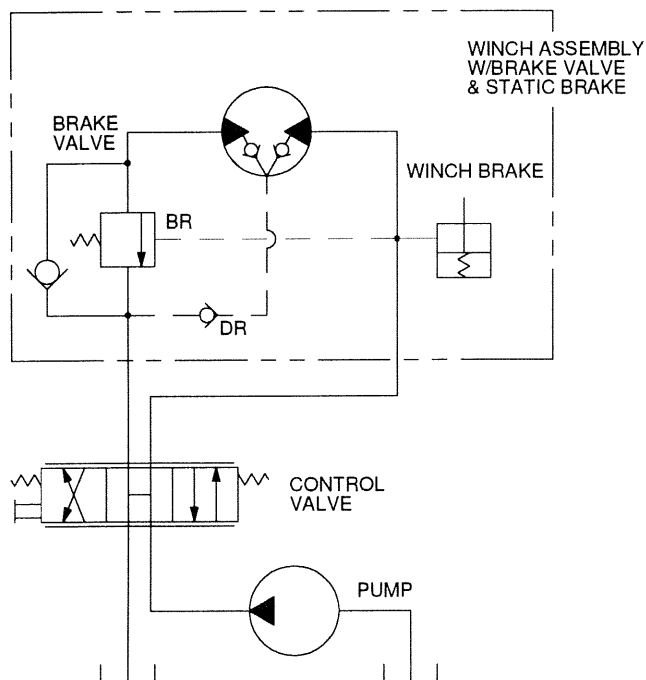
WEDGE PART NO.

CH150A, C2H150A, CH185A, C2H185A	24493* for 7/16 thru 5/8 in. (11 - 16 mm); 24494 3/4 thru 1 in. (19 - 25 mm)
CH230A and C2H230A	24493 for 7/16 thru 5/8 in. (11 - 16 mm); 24494* 3/4 thru 1 in. (19 - 25 mm)
CH175A and C2H175A	24492* for 7/16 in. thru 7/8 in. (11 - 22 mm)

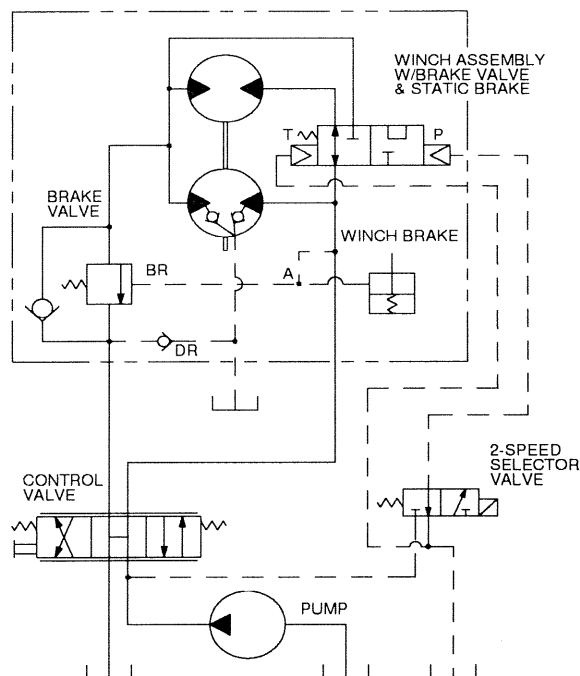
* Standard Anchor

HYDRAULIC CIRCUITS

SINGLE SPEED CIRCUIT



2 SPEED CIRCUIT



RECOMMENDED BOLT TORQUE

The general purpose torque shown in the chart applies to SAE Grade 5 bolts, studs and standard steel full, thick and high nuts.

Higher or lower torques for special applications will be specified such as the use of spanner nuts, nuts on shaft ends, jam nuts and where distortion of parts or gaskets is critical.

Lubricated torque values based on use of SAE 30wt engine oil applied to threads and face of bolt or nut.

Bolt Dia. Inches	Thds Per Inch	Torque LB-FT	
		Dry	Lubed
1/4	20 28	9	6
5/16	18 24	18	13
3/8	16 24	31	23
7/16	14 20	50	27
1/2	13 20	75	55
9/16	12 18	110	80
5/8	11 18	150	115

Bolt Dia. Inches	Thds Per Inch	Torque LB-FT	
		Dry	Lubed
3/4	10 16	265	200
7/8	9 14	420	325
1	8 14	640	485
1 1/8	7 12	790	590
1 1/4	7 12	1110	835
1 3/8	6 12	1460	1095
1 1/2	6 12	1940	1455

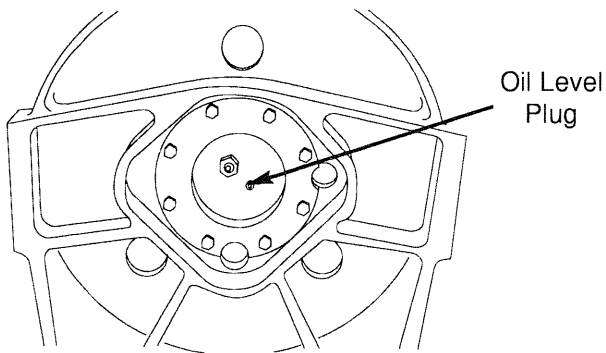
PREVENTIVE MAINTENANCE

A regular program of preventive maintenance for your planetary winch is strongly recommended to minimize the need for emergency servicing and promote safe, reliable winch operation.

Field experience, supported by engineering tests, indicate the three (3) service procedures listed below are the **MOST** critical to safe, reliable winch operation and must be observed.

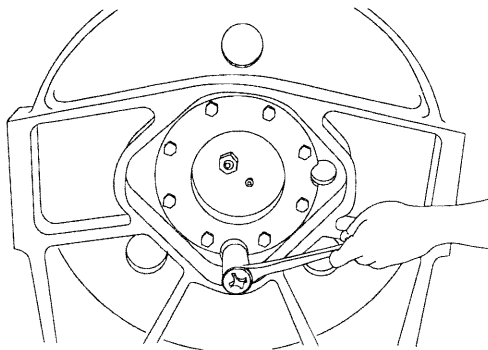
- **Regular Gear Oil Changes** — every 1000 hours or six (6) months
- **Use of Proper Gear Oil** — recommended type for prevailing ambient temperature
- **Annual Disassembly and Inspection of All Wear Items** — in compliance with American National Standards Institute (ANSI) specification B30.5c 1987 and American Petroleum Institute (API) recommended practice RP 2D section 3.

The following minimum service intervals are specified for operating hours of the prime mover.



1. Oil Level

The gear oil level should be checked every 500 operating hours or three (3) months, whichever occurs first. To check the oil level, remove the plug located in the drum support. The oil should be level with the bottom of this opening. If additional oil is needed, refer to "Recommended Planetary Gear Oil".



2. Oil Change

The gear oil should be changed after the first one hundred (100) hours of operation, then every 1,000 oper-

ating hours or six (6) months, whichever occurs first. The gear oil must be changed to remove wear particles that impede the reliable and safe operation of the brake clutch and erode bearings, gears and seals. Failure to change gear oil at these suggested minimum intervals may contribute to intermittent brake slippage which could result in property damage, severe personal injury or death.

The gear oil should also be changed whenever the ambient temperature changes significantly and an oil from a different temperature range would be more appropriate. Oil viscosity with regard to ambient temperature is critical to reliable brake clutch operation. Our tests indicate that excessively heavy or thick gear oil may contribute to intermittent brake clutch slippage. Make certain that the gear oil viscosity used in your winch is correct for your prevailing ambient temperature. Failure to use the proper type and viscosity of planetary gear oil may contribute to brake clutch slippage which could result in property damage, severe personal injury or death. Refer to "Recommended Planetary Gear Oil" for additional information.

3. Vent Plug

The vent plug is located in the drum support as shown. It is very important to keep this vent clean and unobstructed. Whenever gear oil is changed, remove vent plug, clean in solvent and reinstall.

Do not paint over the vent or replace with a solid plug.

4. Hydraulic System

The original filter element should be replaced after the first fifty (50) hours of operation, then every 500 operating hours or three (3) months, or in accordance with the equipment manufacturer's recommendations.

5. Wire Rope

Inspect entire length of wire rope according to wire rope manufacturers recommendations.

6. Mounting Bolts

Tighten all winch base mounting bolts to recommended torque after the first one hundred (100) hours of operation, then every 1000 operating hours or six (6) months, whichever occurs first.

7. Warm-up Procedures

A warm-up procedure is recommended at each start-up and is essential at ambient temperatures below +40°F (4°C).

The prime mover should be run at its lowest recommended RPM with the hydraulic winch control valve in neutral allowing sufficient time to warm up the system. The winch should then be operated at low speeds, forward and reverse, several times to prime all lines with warm hydraulic oil, and to circulate gear lubricant through the planetary gear sets.

⚠ WARNING ⚠

Failure to properly warm up the winch, particularly under low ambient temperature conditions, may result in temporary brake slippage due to high back pressures attempting to release the brake, which could result in property damage, severe personal injury or death.

8. Recommended Planetary Gear Oil

Field experience, supported by extensive engineering tests, indicates the use of the proper planetary gear oil is essential to reliable and safe operation of the brake clutch and obtaining long gear train life.

⚠ WARNING ⚠

Failure to use the proper type and viscosity of planetary gear oil may contribute to intermittent brake clutch slippage which could result in property damage, severe personal injury or death. Some gear lubricants contain large amounts of EP (extreme pressure) and anti-friction additives which may contribute to brake

clutch slippage and damage to brake friction discs or seals. Oil viscosity with regard to ambient temperature is also critical to reliable brake clutch operation. Our tests indicate that excessively heavy or thick gear oil may contribute to intermittent brake clutch slippage. Make certain that the gear oil viscosity used in your winch is correct for your prevailing ambient temperature.

For simplicity, BRADEN has listed one (1) readily available product in each temperature range which has been tested and found to meet our specifications. This is not to say that other lubricant brands would not perform equally as well.

If the following lubricant brands are not available in your area, make certain your lubricant vendor supplies you with oil that is equivalent to those products listed below.

BRADEN planetary winches are factory filled with Texaco Meropa 150 or equivalent API GL-2/3 gear oil.

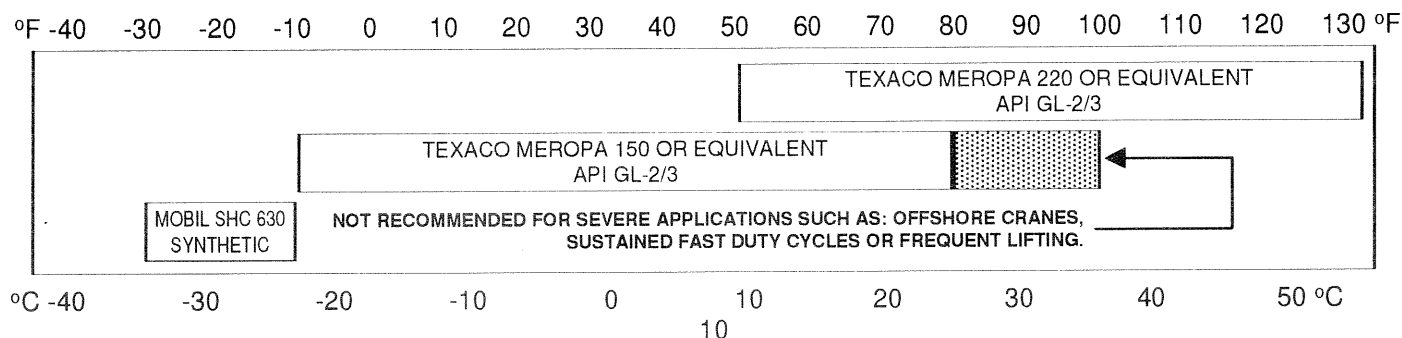
9. Inspection

In compliance with ANSI specification number B30.5c1987 and API Recommended Practice RP 2D section 3, we recommend that the winch be disassembled for a thorough inspection of all wear items every 2,000 hours of operation or twelve (12) months, whichever occurs first.

- A. **Bearings and Gears** — Refer to DISASSEMBLY OF WINCH, item 17 on page 19; and PLANET CARRIER SERVICE, item 3 on page 20.
- B. **Brake Cylinder** — Refer to MOTOR SUPPORT — BRAKE CYLINDER SERVICE, Clean and Inspect, pages 22 and 23.
- C. **Brake Clutch** — Refer to BRAKE CLUTCH SERVICE, item 4 on page 26.

RECOMMENDED GEAR OIL

PREVAILING AMBIENT TEMPERATURE



TROUBLE SHOOTING

⚠ WARNING ⚠

If a winch ever exhibits any sign of erratic operation, or load control difficulties (i.e. load creeping or chattering) appropriate troubleshooting tests and repairs should be performed immediately. Continued operation in this manner may result in property damage, serious personal injury or death.

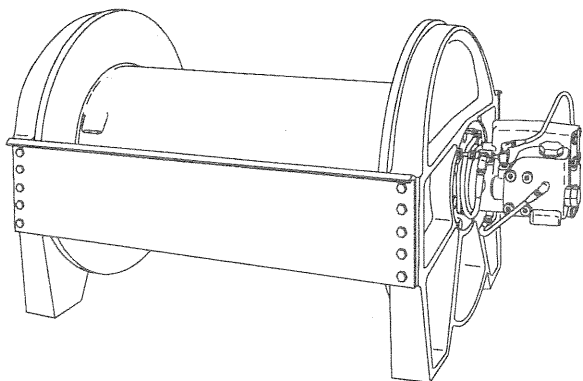
TROUBLE	PROBABLE CAUSE	REMEDY
<p>A</p> <p>The winch will not lower the load or not lower the load smoothly.</p>	<p>1. The problem could be a plugged or loose pilot orifice. The pilot orifice is a small pipe plug with a hole drilled through it, located behind the pilot port fitting on the brake valve. If it becomes plugged, it will prevent the pilot pressure, from the manifold, from opening the brake valve. If it becomes loose, it will allow an unregulated amount of oil in to operate the brake valve which cause erratic brake valve operation.</p>	<p>Remove the pilot hose and fitting from the brake valve, then use a 5/32 inch Allen wrench to remove the pilot orifice. The diameter of the orifice is approximately .020 inches. Clean and install the pilot orifice tightly in the brake valve.</p>
	<p>2. The friction brake may not be releasing as a result of a defective brake cylinder seal.</p> <p>NOTE: If the brake cylinder seal is defective you will usually find oil leaking from the winch vent plug.</p>	<p>Check brake cylinder seal as follows:</p> <p>A. Disconnect the swivel tee from the brake release port. Connect a hand pump with accurate 0-2000 psi gauge and shut-off valve to the -4 J.I.C. fitting in the brake release port.</p> <p>B. Apply 1000 psi to the brake. Close shut-off valve and let stand for five (5) minutes.</p> <p>C. If there is any loss of pressure in five (5) minutes, the brake cylinder should be disassembled for inspection of the sealing surfaces and replacement of the seals. Refer to "Motor Support-Brake Cylinder Service".</p>
	<p>3. Friction brake will not release as a result of damaged brake discs.</p>	<p>Disassemble brake to inspect brake discs. Check stack-up height as described in "Motor Support-Brake Cylinder Service".</p>

TROUBLE	PROBABLE CAUSE	REMEDY
<p style="text-align: center;">B</p> <p>Oil leaks from vent plug.</p>	<ol style="list-style-type: none"> 1. Same as A2. 2. Motor seal may be defective as a result of high system back pressure or contaminated oil. 	<p>Same as A2.</p> <p>System back pressure must not exceed 150 psi. Inspect hydraulic system for a restriction in the return line from the control valve to the reservoir. Be sure control valve and plumbing is properly sized to winch motor.</p> <p>Oil analysis may indicate contamination has worn motor shaft and seal. Thoroughly flush entire hydraulic system and install new filters and oil. Install new motor seal.</p>
<p style="text-align: center;">C</p> <p>The brake will not hold a load with the control lever in neutral.</p>	<ol style="list-style-type: none"> 1. Excessive system back pressure acting on the brake release port. 2. Friction brake will not hold due to worn or damaged brake discs. 3. Brake clutch is slipping. 	<p>The same as Remedy 2 of Trouble B2.</p> <p>Same as Remedy 3 of Trouble A3.</p> <p>Improper planetary gear oil may cause the brake clutch to slip. Drain old gear oil and flush winch with solvent. Thoroughly drain solvent and refill winch with recommended planetary gear oil listed in "Preventive Maintenance".</p> <p>Brake clutch may be damaged or worn. Disassemble and inspect brake clutch as described in "Brake Clutch Service".</p>
<p style="text-align: center;">D</p> <p>The winch will not hoist the rated load</p>	<ol style="list-style-type: none"> 1. The winch may be mounted on an uneven or flexible surface which causes distortion of the winch base and binding of the gear train. Binding in the gear train will absorb horsepower needed to hoist the rated load and cause heat. 2. System relief valve may be set too low. Relief valve needs adjustment or repair. 	<p>Reinforce mounting surface.</p> <p>If necessary, use shim stock to level winch. Refer to "Winch Installation".</p> <p>First loosen, then evenly retighten all winch mounting bolts to recommended torque.</p> <p>Check relief pressure as follows:</p> <ol style="list-style-type: none"> A. Install an accurate 0-4000 psi gauge into the inlet port of the brake valve.

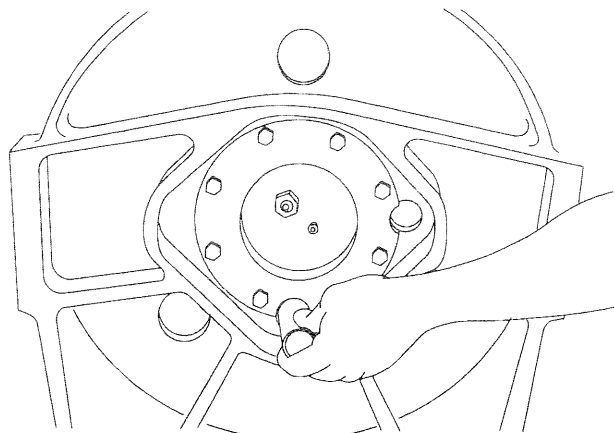
TROUBLE	PROBABLE CAUSE	REMEDY
TROUBLE "D" CONTINUED FROM PREVIOUS PAGE	<p>3. Be certain hydraulic system temperature is not more than 180 degrees F. Excessive hydraulic oil temperatures increase motor internal leakage and reduce motor performance.</p> <p>4. Winch line pull rating is based on 1st layer of wire rope.</p> <p>5. Rigging and sheaves not operating efficiently.</p>	<p>B. Apply a stall pull load on the winch while monitoring pressure.</p> <p>C. Compare gauge reading to winch specifications. Adjust relief valve as required.</p> <p>NOTE: If pressure does not increase in proportion to adjustment, relief valve may be contaminated or worn out. In either case, the relief valve may require disassembly or replacement.</p> <p>Same as remedies for Trouble D1 & D2.</p> <p>Same as remedies for Trouble E2.</p> <p>Refer to winch performance charts for additional information.</p> <p>Perform rigging service as recommended by crane manufacturer.</p>
<p>E</p> <p>The winch runs hot.</p>	<p>1. Same as D1.</p> <p>2. Be certain that the hydraulic system temperature is not more than 180 degrees F. Excessive hydraulic oil temperatures may be caused by:</p> <p>A. Plugged heat exchanger.</p> <p>B. Too low or too high oil level in hydraulic reservoir.</p> <p>C. Same as D2.</p> <p>D. Hydraulic pump not operating efficiently.</p> <p>3. Excessively worn or damaged internal winch parts.</p>	<p>Same as remedies for Trouble D1.</p> <p>Thoroughly clean exterior and flush interior.</p> <p>Fill/drain to proper level.</p> <p>Same as remedies for Trouble D2.</p> <p>Prime mover low on horsepower or R.P.M. Tune/adjust prime mover.</p> <p>Check suction line for damage.</p> <p>If pump is belt driven, belts are slipping. Replace/tighten belts.</p> <p>Pump worn. Replace pump.</p> <p>Disassemble winch to inspect/replace worn parts.</p>

TROUBLE	PROBABLE CAUSE	REMEDY
<p style="text-align: center;">F</p> <p>Winch "chatters" while raising rated load.</p>	<ol style="list-style-type: none"> 1. Same as D2. 2. Hydraulic oil flow to motor may be too low. 3. Controls being operated too quickly. 	<p>Same as remedies for Trouble D2.</p> <p>Same as remedies for Trouble E2.</p> <p>Conduct operator training as required.</p>
<p style="text-align: center;">G</p> <p>The wire rope does not spool smoothly on the drum.</p>	<ol style="list-style-type: none"> 1. The winch may be mounted too close to the main sheave, causing the fleet angle to be more than 1½ degrees. 2. The winch may not be mounted perpendicular to an imaginary line between the center of the cable drum and the first sheave. 3. Could possibly be using the wrong lay rope. There is a distinct advantage in applying rope of the proper direction of lay. When the load is slacked off, the several coils on the drum will stay closer together and maintain an even layer. If rope of improper lay is used, the coils will spread apart each time the load is removed. Then, when winding is resumed, the rope has a tendency to criss-cross and overlap on the drum. The result is apt to be a flattened and crushed rope. 4. The winch may have been overloaded, causing permanent set in the wire rope. 	<p>Check mounting distance and fleet angle. Reposition winch as required.</p> <p>Refer to "Winch Installation".</p> <p>Consult wire rope manufacturer for recommendation of wire rope that best suits your application.</p> <p>Replace wire rope and conduct operator/rigger training as required.</p>

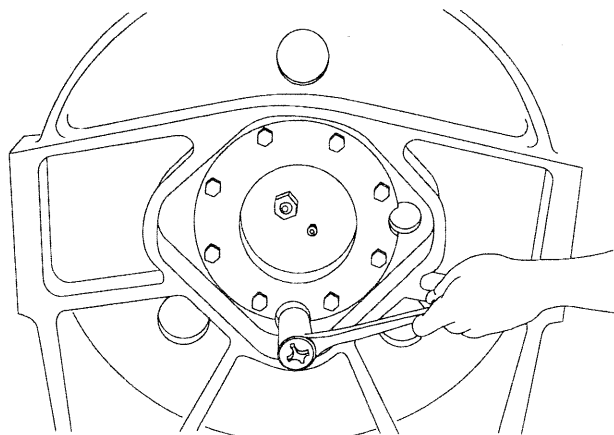
DISASSEMBLY PROCEDURE FOR HOIST



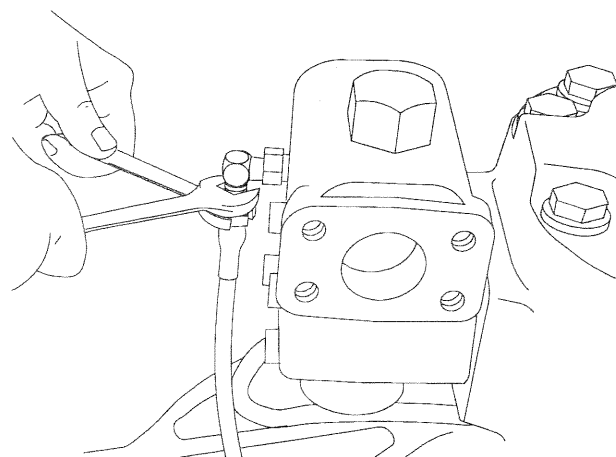
1. Remove the wire rope from the hoist drum and align the drain plug in the drum with the hole in the support end plate before removing the hoses and mounting bolts. After the hoist is removed from its mounting, clean the outside surfaces.



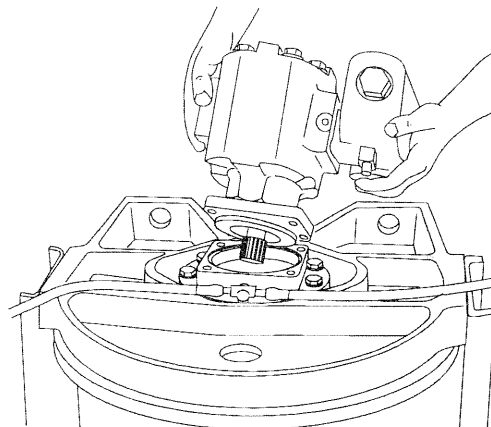
2. To drain the oil, screw a short piece of 1" pipe into the larger threads of the drain hole.



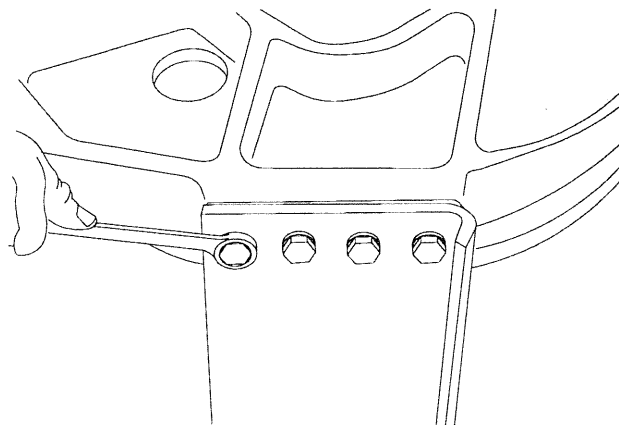
3. Use a 3/8" drive extension to remove the drain plug through the pipe. If the drain holes were not aligned before the hoist was removed from its mounting, the oil can be drained through the fill/vent plug in the bearing support by turning the hoist up on the bearing support end.



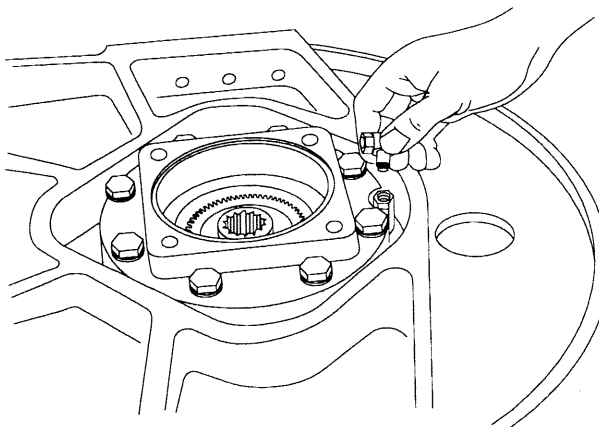
4. Begin the disassembly by standing the hoist on the end opposite the motor. Tag and remove the hydraulic hoses that connect the brake valve and the motor (manifold in the case of a two-speed motor) to the brake release port.



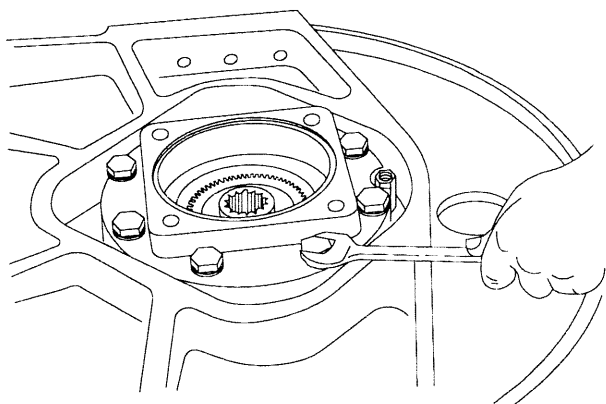
5. Remove the four (4) capscrews and lockwashers securing the motor and lift the motor off the hoist. Remove and discard the O-ring installed on the outside of the motor pilot.



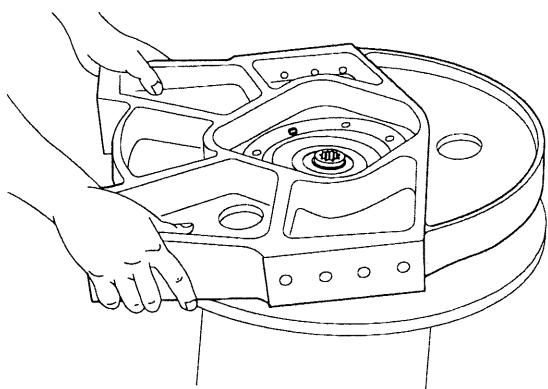
6. Remove the sixteen (16) capscrews and lockwashers (20 in the CH185A and C2H185A models) from the two (2) tie plates, and remove the plates.



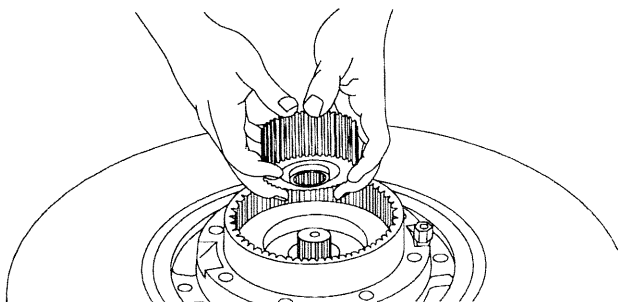
7. Remove the tee fitting from the brake cylinder nipple.



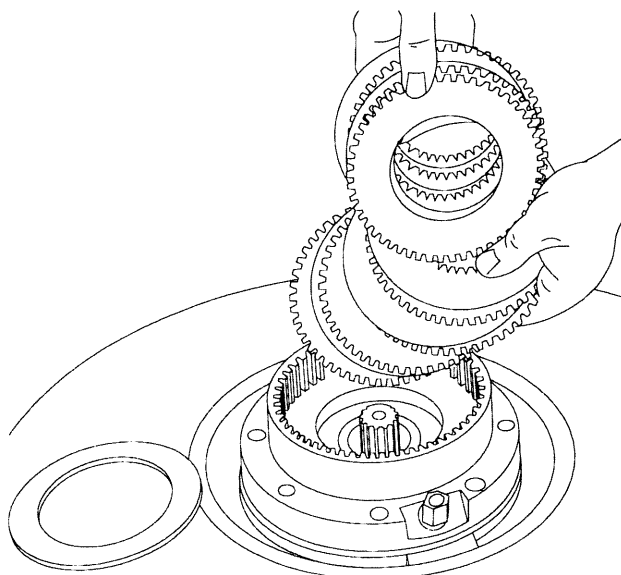
8. Remove the eight (8) capscrews and lockwashers from the motor adapter, and remove the motor adapter. Remove and discard the O-ring that was under the motor adapter.



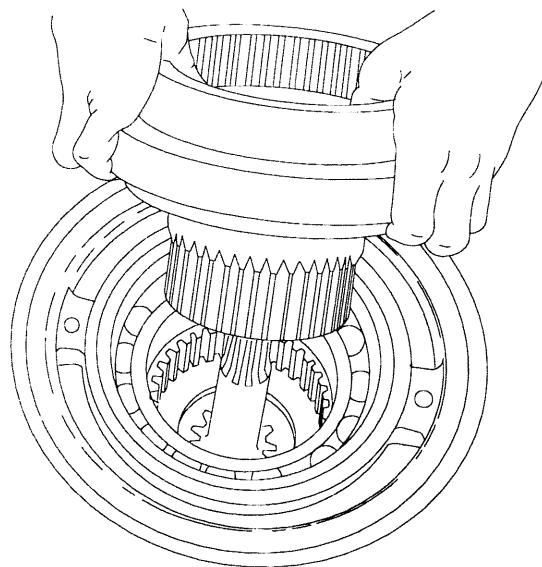
9. Remove the brake cylinder nipple, then remove the motor end plate.



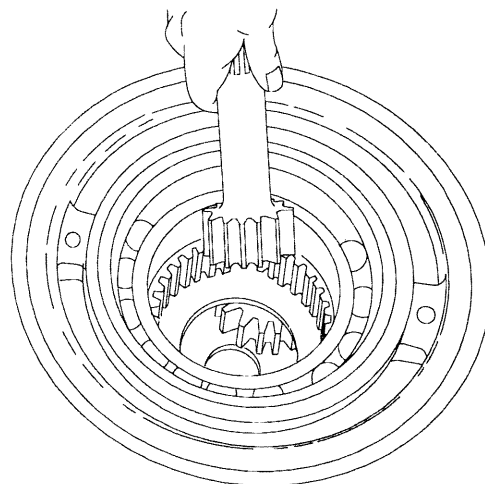
10. Remove the brake clutch assembly from the brake cylinder. Refer to the section on disassembly of the brake clutch assembly.



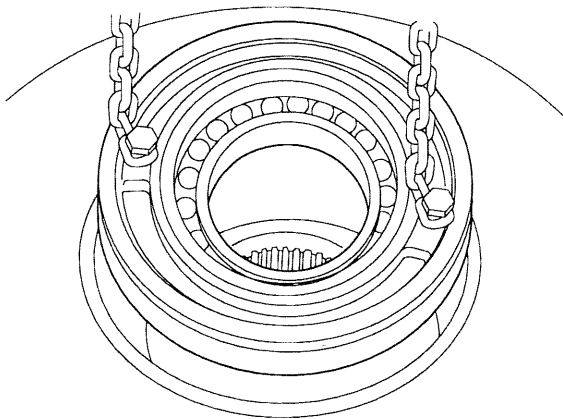
11. Remove the brake plate spacer and brake and friction discs.



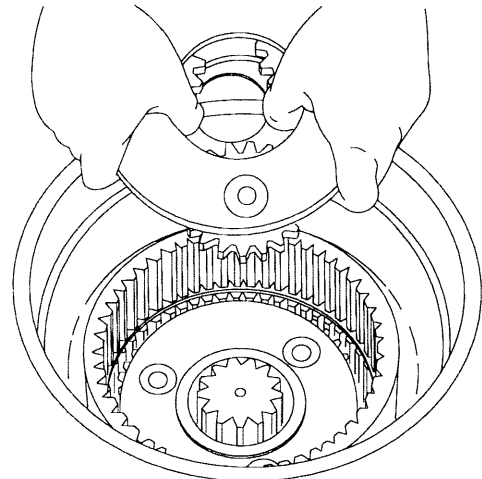
12. Remove the brake cylinder assembly, and place it on a clean, dry surface so as not to damage the splines. Refer to the section on disassembly of the brake cylinder assembly.



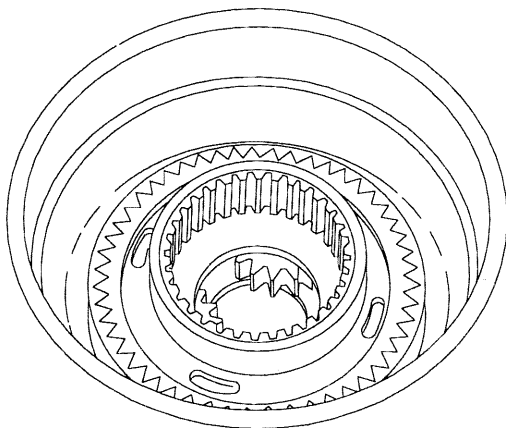
13. Next, remove the primary sun gear.



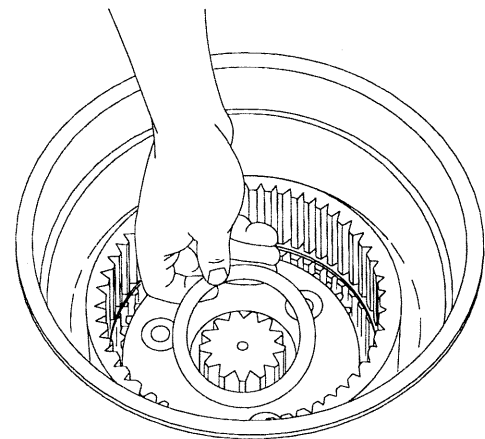
14. Remove the cable drum closure by using two (2) cap screws from the motor adapter and a short piece of chain. Lift the closure out of the drum. Remove and discard the O-ring and the seal. Inspect the bearing for wear. If replacement is necessary, use a bearing driver to remove the bearing.



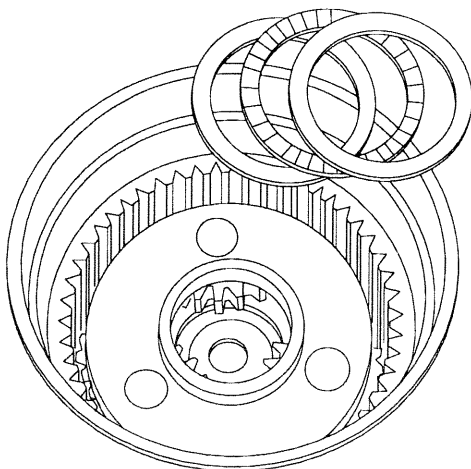
17. Remove the primary planet carrier assembly. Refer to the section on disassembly of the primary planet carrier assembly.



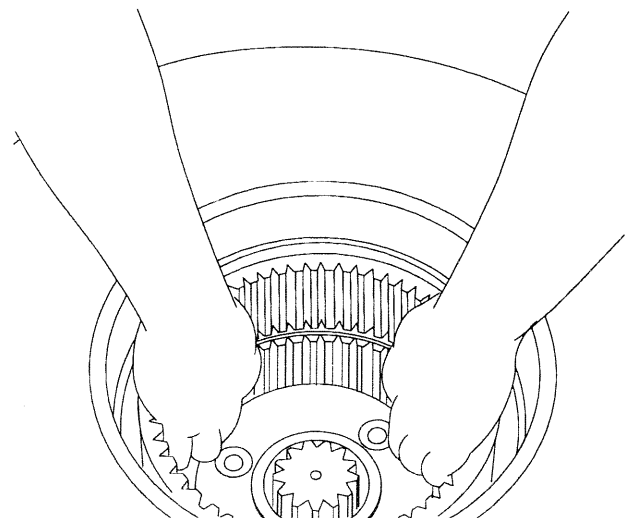
15. Lift out the ring gear adapter.



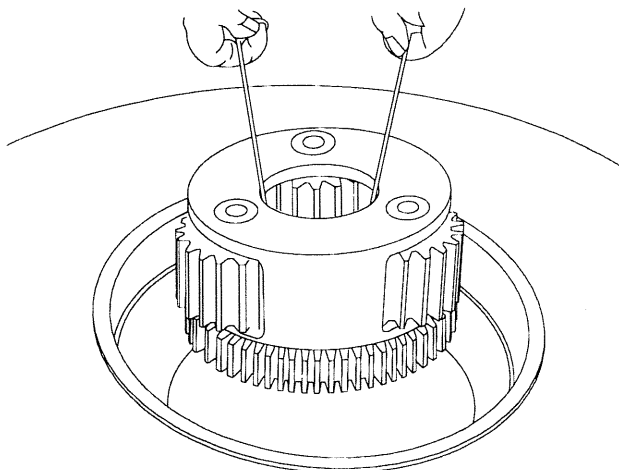
18. Remove the thrust bearing that was under the primary planet carrier assembly, then remove the output sun gear.



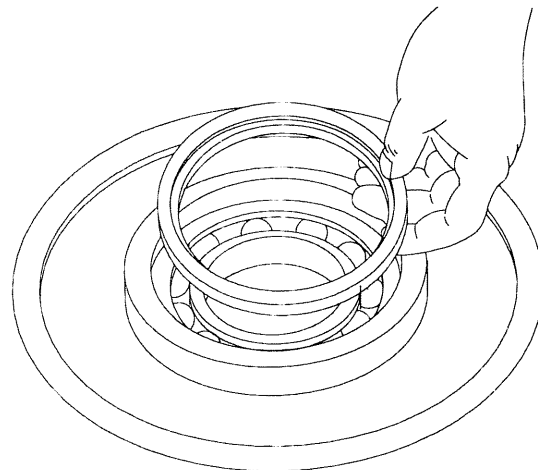
16. Remove thrust bearing and two races.



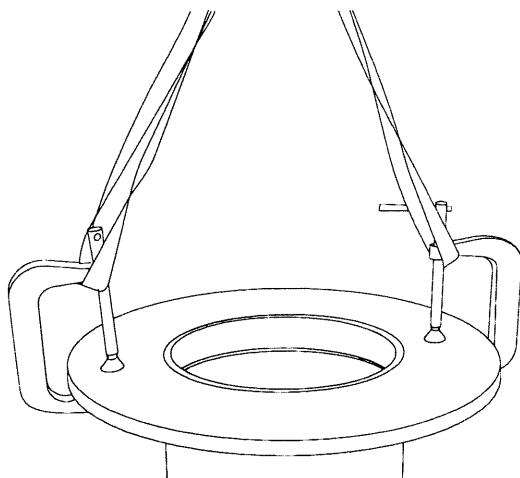
19. Lift out the ring gear. Inspect the gear for abnormal wear or pitting.



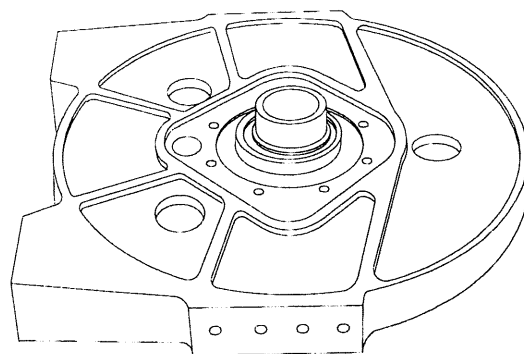
20. Remove the output planet carrier assembly. You can make hooks like the ones shown to make removal easier. Refer to the section on disassembly of the output planet carrier assembly.



22. Turn the drum over and remove and discard the seal. Inspect the bearing in the end of drum. If replacement is necessary, use a bearing driver to remove the bearing.

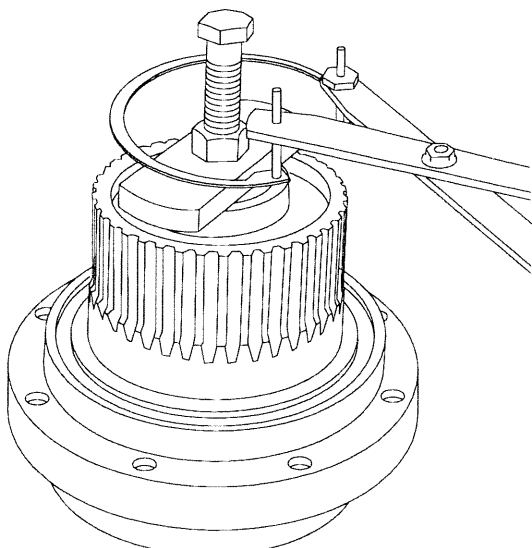


21. Lift the drum off the support end plate.



23. Check the bearing support sealing surface for nicks and burrs. It is not necessary to remove the bearing support from the support end plate unless it has been damaged.

BRAKE CYLINDER SERVICE

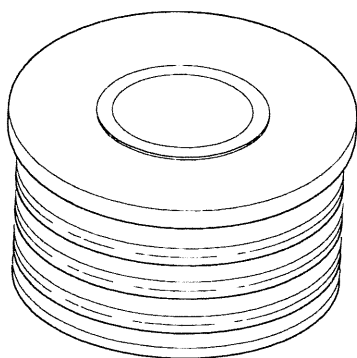


1. Turn the brake cylinder on end with the large end down. Use the special compression tool or a shop press to compress the backup plate in order to remove the retaining ring.

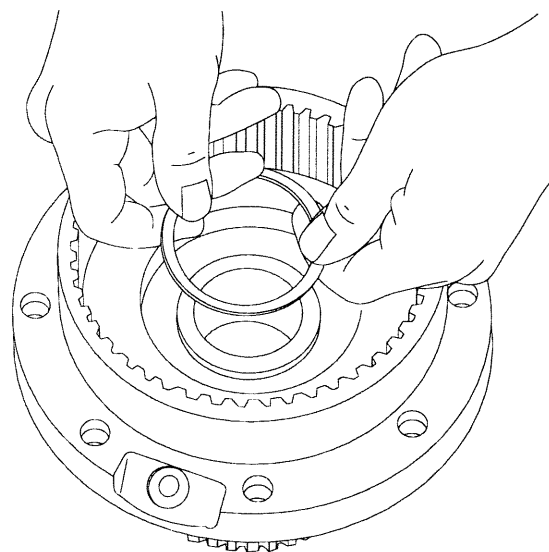
⚠ CAUTION ⚠

CAUTION: Make certain that the threaded rod of the compression tool fully engages the lower plate. If a press is used, be careful not to damage any parts by applying too much pressure.

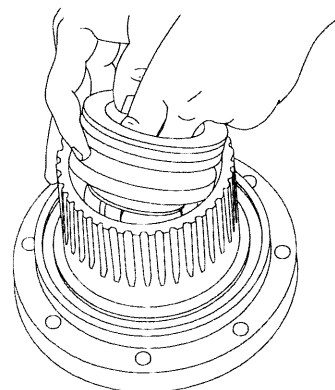
Remove the retaining ring with snap ring pliers. Be careful to not let the pliers slip out of the retaining ring. Release the compression tool by holding the threaded rod stationary while backing off the nut.



2. Remove the spring guide. The backup plate, belleville springs and spring guide will come out together. Closely inspect the spring guide for damage that might prevent the springs from moving freely in an axial direction. Also inspect the springs for cracks and material displacement. Replace any defective parts.

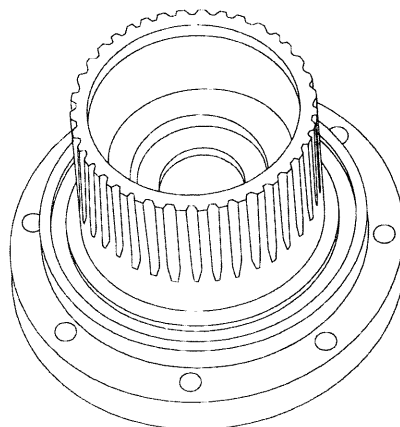


3. Turn the brake cylinder on end with the large end up. Remove the spiral retaining ring and lift out the brake piston plate.



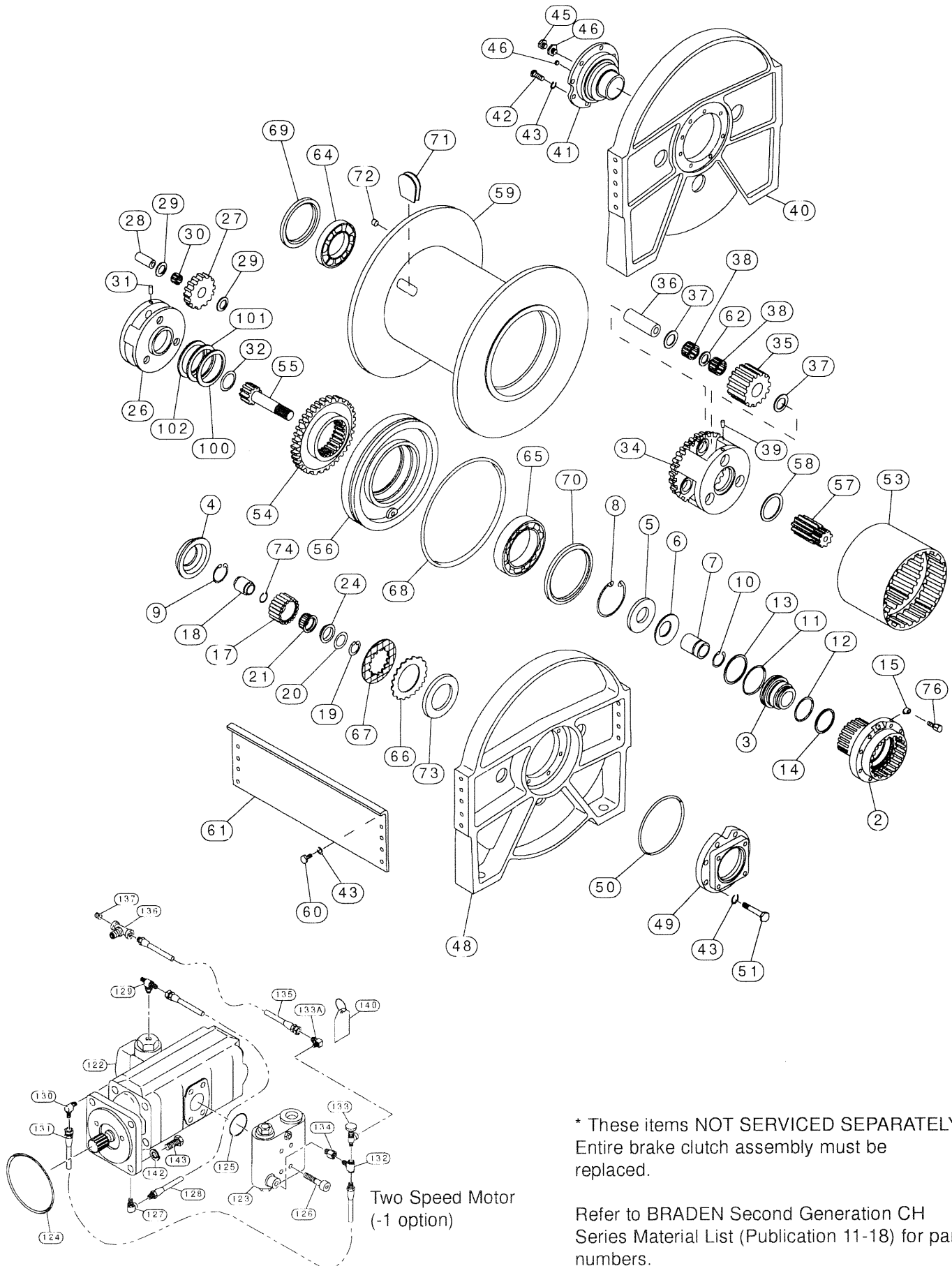
4. Turn the brake cylinder over and pull the piston out.

Remove and discard the O-rings. Inspect the backup rings for nicks or cuts, and replace if necessary. Be careful not to damage the O-ring groove surfaces.

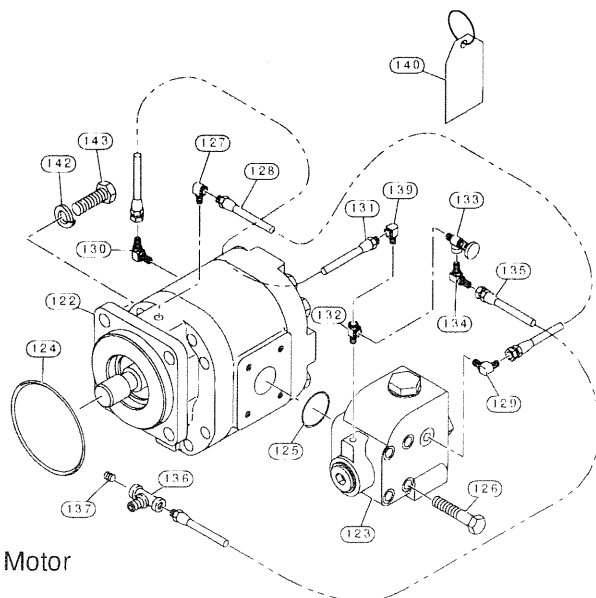


5. Inspect the brake cylinder for nicks and scratches on the O-ring sealing area. Check the internal splines for notches that might prevent the brake discs from sliding freely. Be careful not to damage the O-ring sealing surfaces.

SECOND GENERATION CH SERIES EXPLODED VIEW AND PARTS KEY



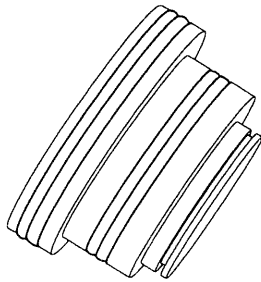
ITEM	DESCRIPTION	QTY.
2	Brake Cylinder	1
3	Brake Piston	1
4	Brake Piston Plate	1
5	Backup Plate	1
6	Belleville Spring	8
7	Spring Guide	1
8	Retaining Ring	1
9	Snap Ring	1
10	Snap Ring	1
11	O-Ring	1
12	O-Ring	1
13	Backup Ring	1
14	Backup Ring	1
15	Street Elbow - 45°	1
17	Outer Brake Race*	1
18	Inner Brake Race*	1
19	Snap Ring	2
20	Sprag Bearing Retainer	2
21	Sprag Clutch*	1
24	Sprag Bearing	1
26	Primary Planet Carrier	1
27	Primary Planet Gear	3
28	Primary Planet Gear Shaft	3
29	Thrust Washer	6
29	Thrust Washer	6
30	Roller Bearing	3
31	Spirol Pin	3
32	Thrust Washer	1
34	Output Planet Carrier	1
35	Output Planet Gear	3
36	Output Planet Gear Shaft	3
37	Thrust Washer	6
38	Roller Bearing	6
39	Spirol Pin	3
40	Support End Plate	1
41	Bearing Support	1
42	Capscrew	8



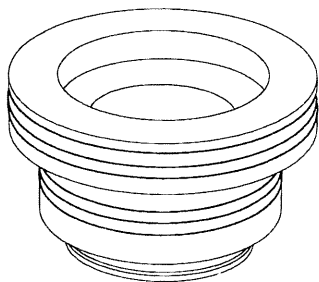
Single Speed Motor
(-1 option)

ITEM	DESCRIPTION	QTY.
43	Lockwasher	36
44	Reducer Bushing	1
45	Relief Valve	1
46	Sight Glass	1
46	Pipe Plug	1
48	Motor End Plate	1
49	Motor Adapter	1
50	O-Ring	1
51	Capscrew	8
53	Ring Gear	1
54	Ring Gear Adapter	1
55	Primary Sun Gear	1
56	Cable Drum Closure	1
57	Output Sun Gear	1
58	Thrust Washer	1
59	Cable Drum	1
60	Capscrew	16
61	Tie Plate	2
62	Bearing Spacer	3
64	Ball Bearing	1
65	Ball Bearing	1
66	Brake Disc	10
67	Friction Disc	9
68	O-Ring	1
69	Oil Seal	1
70	Oil Seal	1
71	Cable Anchor Wedge	1
72	Plug	1
73	Brake Plate Spacer	1
74	Retaining Ring	1
76	Pipe Nipple	1
100	Bearing Race (.092" thick)	1
101	Thrust Bearing	1
102	Bearing Race (.063" thick)	1
122	Hydraulic Motor	1
123	Brake Valve	1
124	O-Ring	1
125	O-Ring	1
126	Capscrew	4
127	Elbow Fitting (90°)	1
128	Hose Assembly	1
129	Fitting	1
130	Elbow Fitting (90°)	1
131	Hose Assembly	1
132	Tee Fitting	1
133	Needle Valve	1
133a	Elbow Fitting (90°)	1
134	Fitting	1
135	Hose Assembly	1
135	Tee Fitting	1
136	Tee Fitting	1
137	Plug	1
139	Elbow Fitting (90°)	1
140	Warning Tag	1
142	Lockwasher	4
143	Capscrew	4

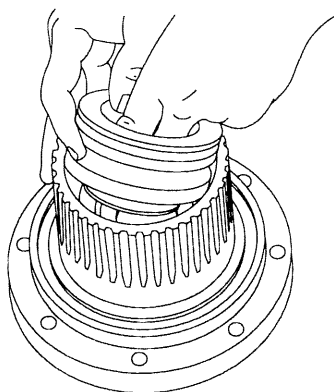
BRAKE CYLINDER ASSEMBLY



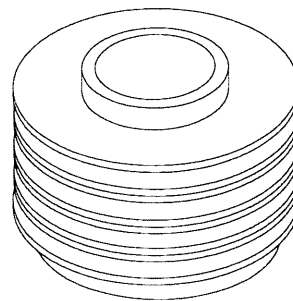
1. Lubricate O-rings and backup rings with oil and install them on the brake piston. The concave surface of the backdrop ring must be next to the O-ring. Let the assembly set for 10 minutes in order for the O-rings and backup rings to return to their original shape.



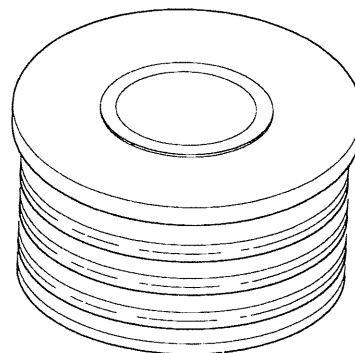
2. Here are the backup rings and O-rings installed correctly. The backup rings must be to the outside of the O-rings.
3. Lubricate the outside of the piston with oil or grease.



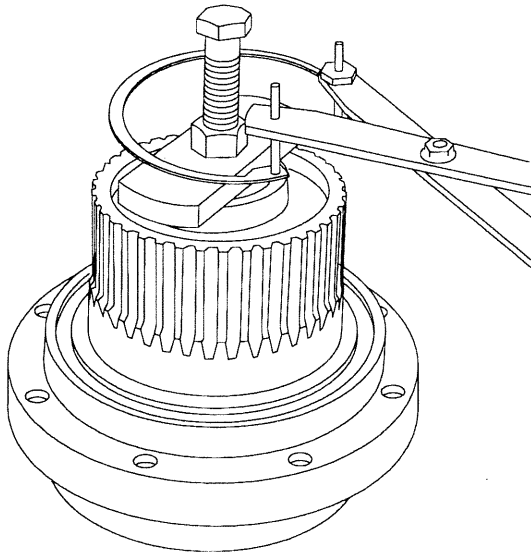
4. With the brake cylinder resting on its large end, insert the piston into the brake cylinder. Be careful not to cut the O-rings or backup rings.



5. Install the eight (8) belleville springs over the spring guide. The first one should rest against the snap ring on the spring guide, with the concave side facing the snap ring. The second spring should be installed with its convex side facing the snap ring. Alternate the remaining six (6) springs until all eight (8) are in place.

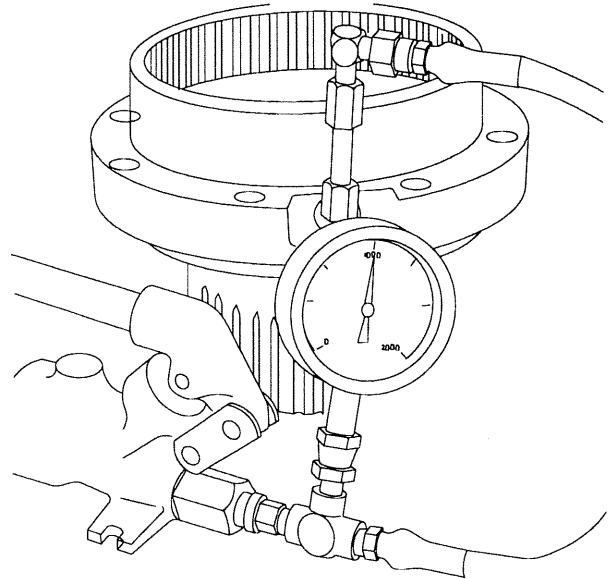


6. Next, place the backup plate over the spring guide so that it rests on the top spring. Then, insert the spring guide, springs and backup plate into the brake cylinder.



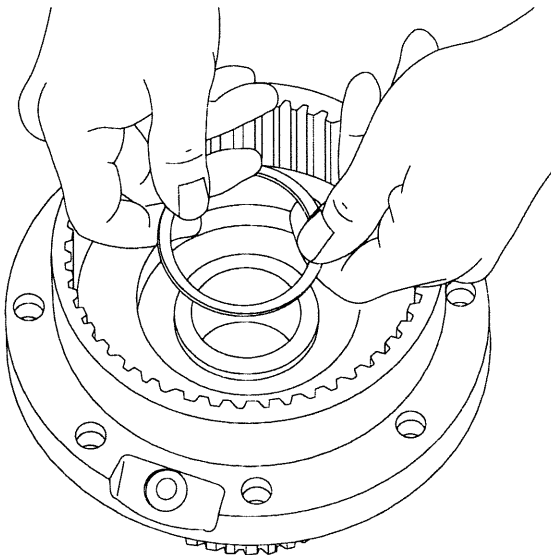
7. Use a press or the special compression tool to compress the springs. Make certain the threaded portion of the compression tool fully engages the lower plate. Install the retaining ring using snap ring pliers. Be careful to not let the pliers slip out of the retaining ring.

After making certain the retaining ring is in place, release the compression tool slowly, holding the threaded portion of the tool stationary, while backing off the nut.



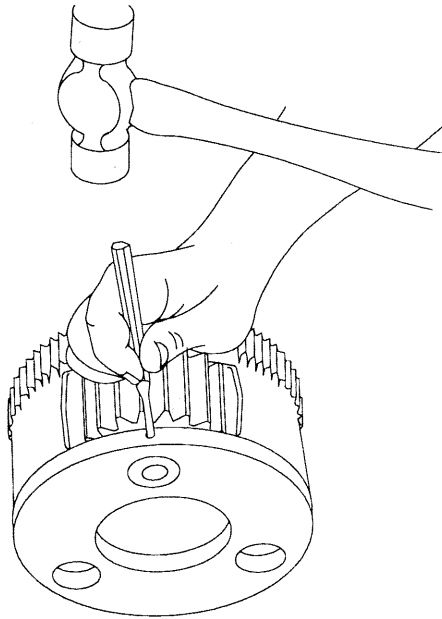
9. Now pressure check the brake cylinder assembly with the hand pump connected to the 1/8" NPTF elbow in the top of the assembly.

Apply 1000 psi and let the unit set for 5 minutes. If the gauge does not register a pressure drop, it means you have installed the O-rings and backup rings correctly.

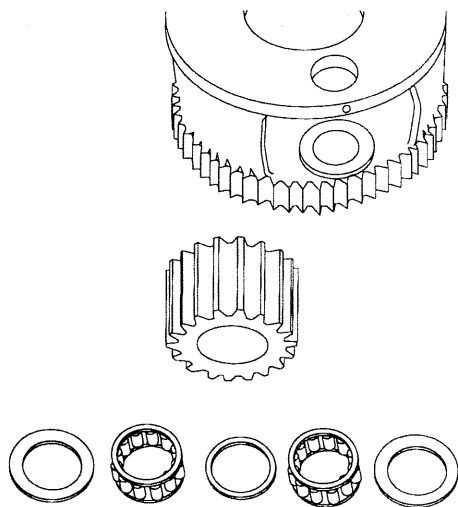


8. Turn the assembly over and place the brake piston plate over the brake piston. Install the spiral retaining ring in the groove in the brake piston.

OUTPUT PLANET CARRIER SERVICE

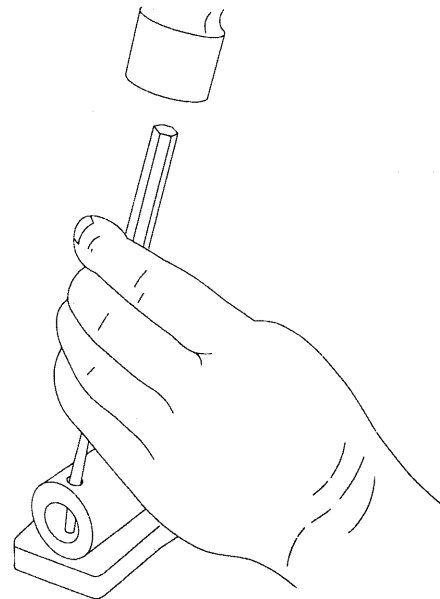


1. Drive the three (3) spiral pins into the center of the planet gear shafts.



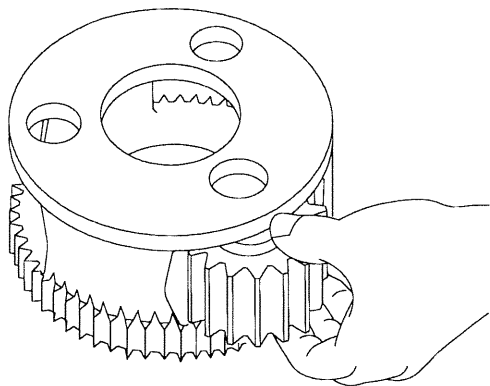
2. Remove one (1) planet gear shaft, two (2) thrust washers, two (2) roller bearings and one (1) planet gear from each of three (3) locations in the carrier. The CH150A, C2H150A, CH175A and C2H175A also have a bearing spacer between each pair of bearings that has to be removed.

3. To disassemble the primary planet carrier assembly, the steps are the same as for the output planet carrier assembly, except there is only one bearing for each gear. Also, the primary carrier has a thrust washer inside that can be removed after the planet gears are removed.
4. If the rollers show any sign of spalling, corrosion, discoloration, material displacement or abnormal wear, the bearing should be replaced. Likewise, the cage should be inspected for unusual wear or deformation, particularly the cage bars. If there is any damage that will impair the cage's ability to separate, retain and guide the rollers properly, the bearing should be replaced. The thrust washer contact areas should be free from any surface irregularities that cause excessive abrasion or friction. The gears should be inspected for abnormal wear or pitting. Replace if necessary.

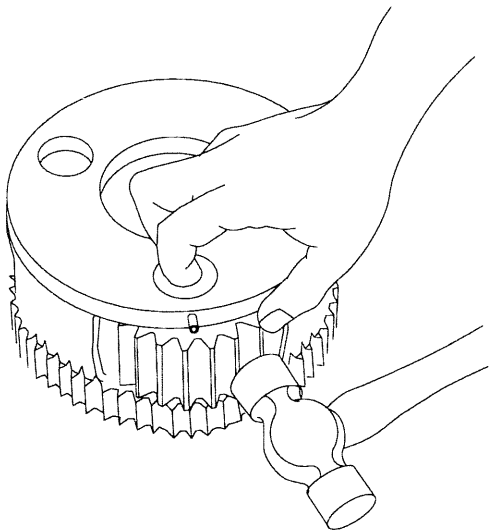


5. Use a punch to drive the spiral pins out of the planet gear shafts. The same surface and material conditions that are detrimental to the life of the bearings and thrust washers also apply to the contact areas on the shafts and carrier.

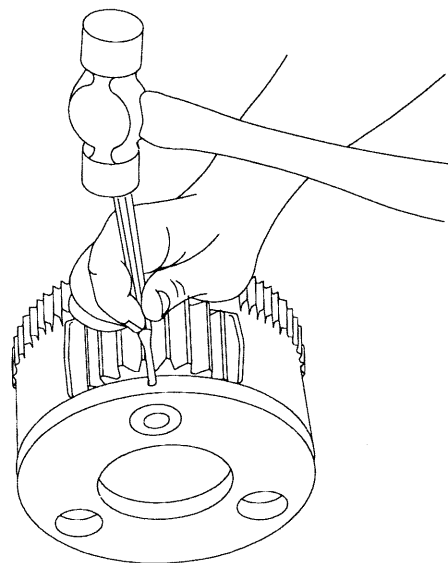
OUTPUT PLANET CARRIER ASSEMBLY



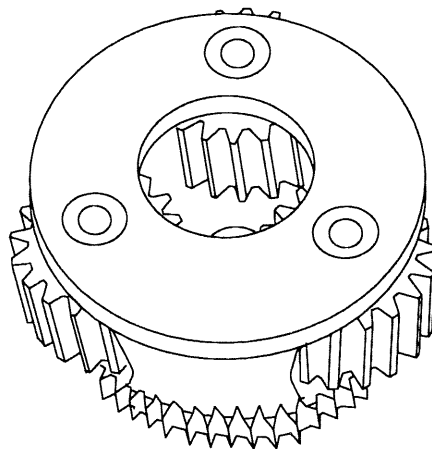
1. Insert two bearings into a gear (when assembling the output planet carrier assembly for a CH150A, C2H150A, CH175A or C2H175A, install a bearing spacer between the two bearings). Place a thrust washer on each side of the gear and install it in a carrier opening. Slide a shaft through the carrier, thrust washers, bearings and gear.



2. Align the hole in the carrier and shaft so a spiral pin can be installed. Always use a new 3/16" x 3/4" spiral pins when assembling these carriers. Use spiral pins, because they are much stronger than roll pins.



3. Drive a spiral pin into place. Note that it is slightly recessed in the carrier when it is in the proper position. Use a center punch to dent the carrier next to the hole as shown. This will distort the hole so the pin will not work itself out. Repeat these steps for each of the three planet gears.



4. This is how the output planet carrier should look after you assemble it.

To assemble the primary planet carrier assembly, the steps are the same as for the output planet carrier assembly, except there is only one bearing for each gear. Also, the thrust washer must be installed inside the carrier on the hub end before the planet gears are installed.

CLEAN AND INSPECT

Thoroughly clean all of the parts in a good grade of cleaning solvent; one that is not flammable, not toxic and will not cause skin rashes. If necessary, use rubber gloves.

Inspect all parts for wear, nicks, scratches and damage that would render them unusable. If a part is questionable, it is better to replace it rather than take a chance on premature failure when the hoist is placed back in service.

Always replace O-rings, seals and spiral pins. Sometimes it is permissible to reuse bearings and bushings . . . it depends on how much use they have had.

At regular service intervals, the cage and roller bearing assemblies and thrust washers in the planet carrier assemblies should be inspected to insure beyond any doubt that they will function properly when re-installed.

The rollers should not exhibit any surface irregularities. If the rollers show any sign of spalling, corrosion, discoloration, material displacement or abnormal wear, the bearings should be replaced. Likewise, the cage should be inspected for unusual wear or deformation, particularly the cage bars. If there is any damage that will impair the cage's ability to separate, retain and guide the rollers properly, the bearing should be replaced.

The thrust washer contact areas should be free from any surface irregularity that causes excessive abrasion or friction.

Finally, the shafts and carrier should be checked where there is roller or thrust washer contact. The same surface and material conditions that are detrimental to the life of the bearing and thrust washer also apply to the contact areas on the shaft and carrier.

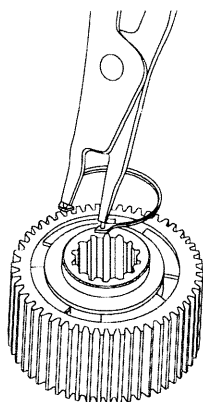
If the hoist was disassembled only to replace damaged seals after a short period of service, it is not necessary to replace the bearings. Experience and common sense, along with a good inspection, will determine if they can be used again.

Always coat O-rings, bearings, bushings and the rubber parts of seals with oil or grease during assembly.

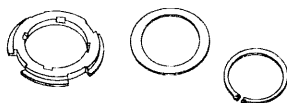
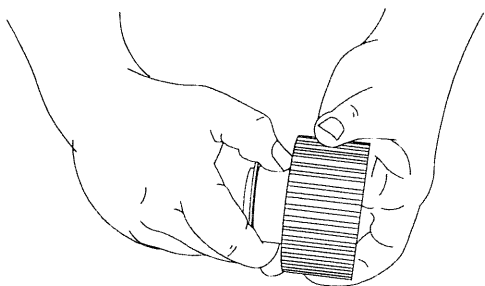
Use a sealing compound on the outside diameter of seals and a light coat of thread sealing compound or sealing tape on pipe fittings and plugs. Be careful not to get this compound or tape inside parts and passages which conduct oil.

BRAKE CLUTCH SERVICE

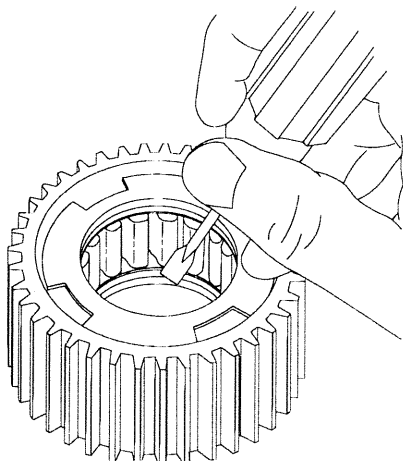
DISASSEMBLY



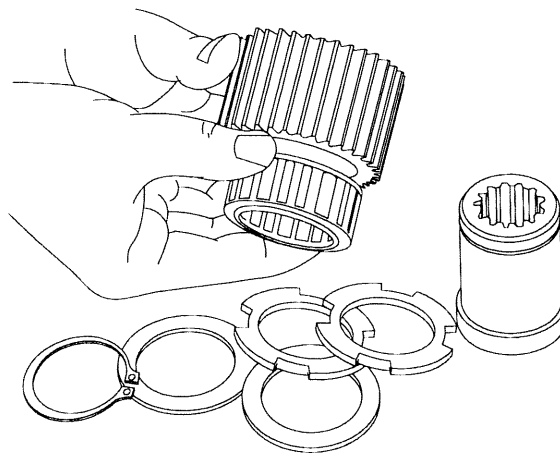
1. Remove the snap ring and sprag bushing retainer from one end only.



2. Pull the inner race out. Examine the race for scoring, wear or indentations caused by the sprag cams. If the inner race is not completely smooth, the entire brake clutch assembly must be replaced.



3. Use a screwdriver and mallet to remove the sprag bushing from one end of the outer race. There are four special cut-outs in the bushing for this purpose. Be careful not to damage the bushing inside surface. If a bushing's inside surface is damaged or shows wear, replace it.

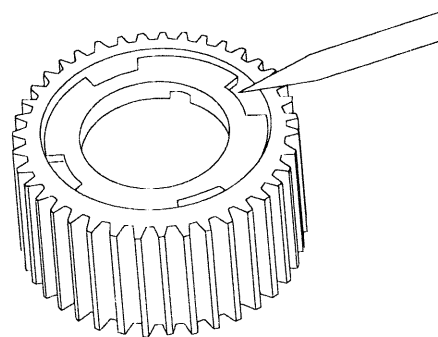


4. Next, slide the sprag clutch out, inspect the sprag clutch closely for abnormal wear, cracks, pitting or corrosion. Check small clips for breakage or bright spots; the signs of excessive wear. Unless the outer race or remaining sprag bushing is damaged or shows excessive wear, there is no need for further disassembly. If disassembly is necessary, remove the bushing according to the procedure covered in Step No. three (3). All brake clutch assembly parts should be thoroughly cleaned and inspected before assembly.

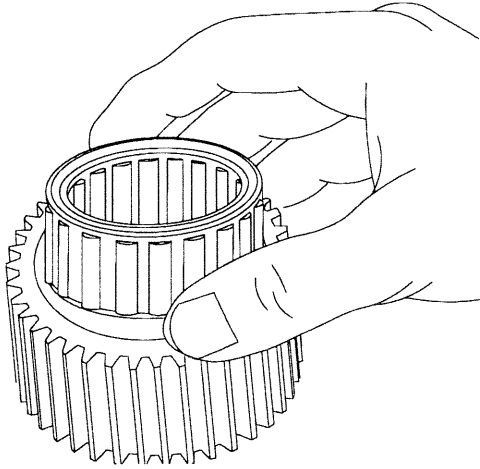
⚠ WARNING ⚠

The polished surfaces of the races and sprag cams must be perfectly smooth to insure positive engagement of the clutch. The slightest defect may reduce brake clutch effectiveness, which could result in property damage, severe personal injury or death. It is generally recommended to replace the entire brake clutch assembly if any component is defective.

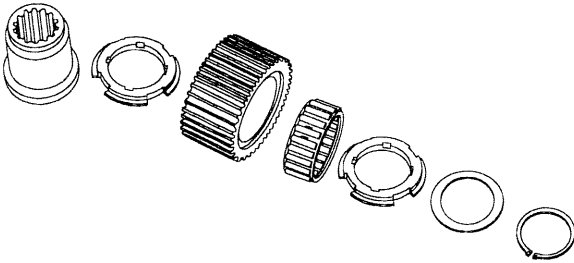
ASSEMBLY



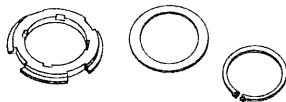
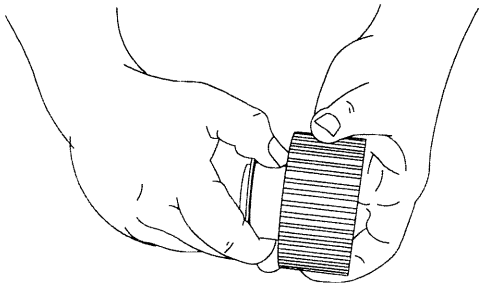
1. Press a sprag bushing into the outer race, using a mechanical or hydraulic press. A flat plate of approximately the same diameter as the bushing flange outside diameter should be placed between the press and bushing during assembly to protect the bushing. Be certain the bushing flange is against the shoulder in the outer race.



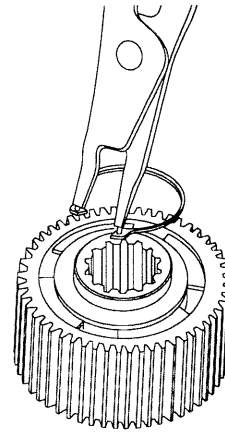
2. Turn the assembly over and install the sprag clutch in the bore of the outer race.
3. Press the remaining bushing into the race. Again, make sure the bushing is against the shoulder.



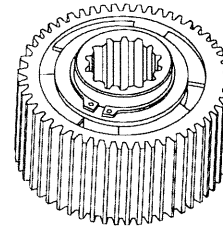
4. Next, install a sprag bushing retainer, then a snap ring on the inner race. Be sure the snap ring is seated in the snap ring groove.



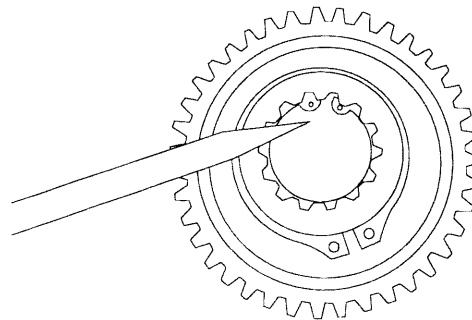
5. Slide the inner race through the bushings and sprag clutch (the race will have to be rotated in the free-wheeling direction to start it through the sprag clutch). If the inner race will not go through the bushings, the bushings have probably been damaged and should be replaced.



6. Turn the assembly over with the snap ring down. Install the second retainer and snap ring. Make certain the snap ring is seated in the groove properly.



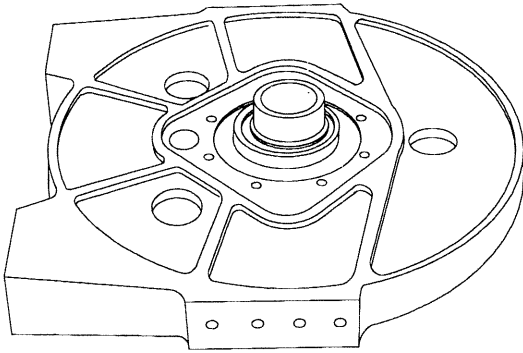
7. This is a completed brake clutch assembly.



⚠ WARNING ⚠

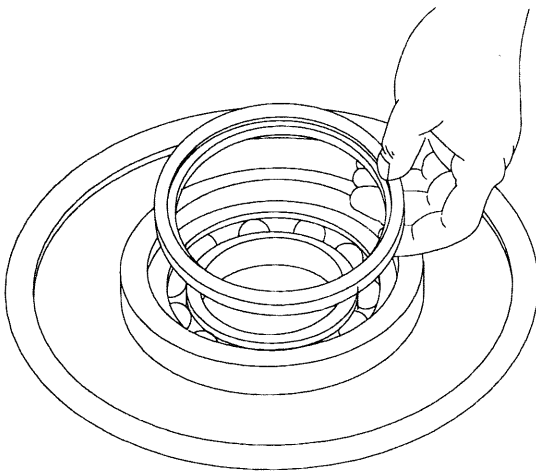
Be certain the snap ring is seated in the groove in the splined bore of the inner race. This snap ring will keep the brake clutch assembly correctly positioned in the center of the friction brake pack. Binding of the brake or brake failure may occur if this snap ring is omitted.

HOIST ASSEMBLY

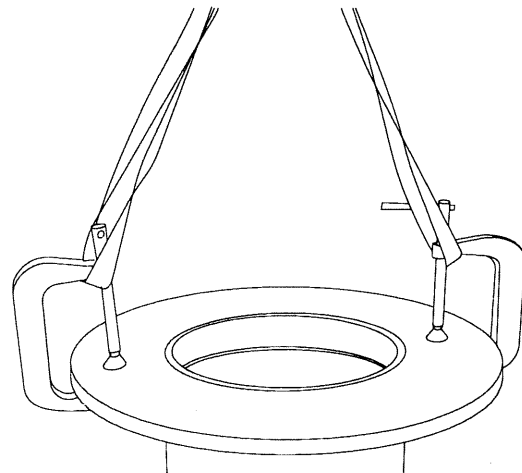


1. Clean all parts before reassembling. The first step is to lay the support end plate down with the bearing support up. Lubricate the sealing and bearing lands on the bearing support.

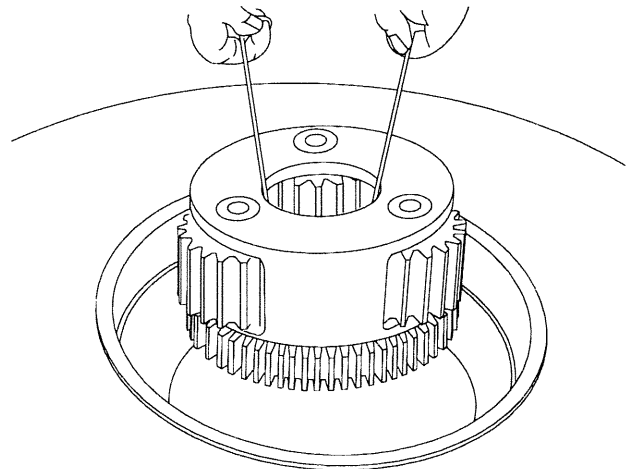
NOTE: If the bearing support was removed from the end plate, reinstall it with eight (8) capscrews and lock-washers, making certain two (2) large holes in the end plate line up with the cutouts in the bearing support.



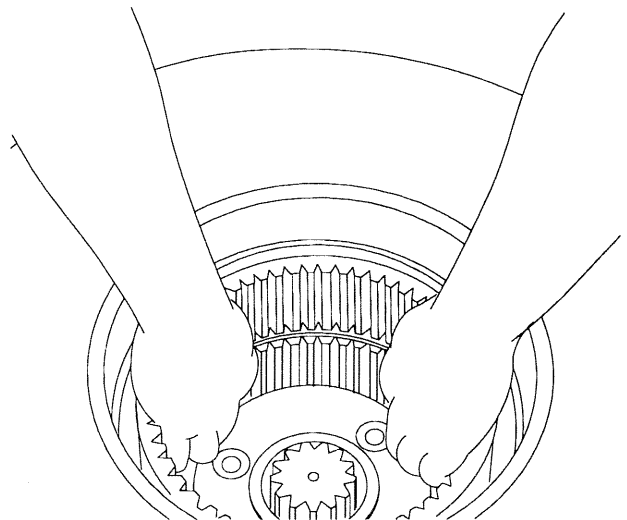
2. Install a new bearing in the drum if replacement is necessary, making certain to press it against the shoulder in the bottom of the bearing bore. Coat the outside diameter of the new seal with a good grade of sealant. Turn the spring side of the seal next to the bearing, and press the seal into the seal bore, leaving it flush with the surface shown.



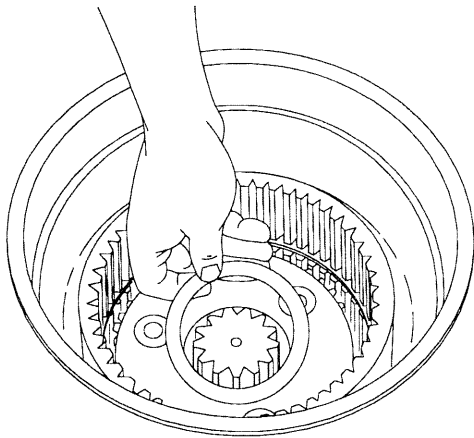
3. Turn the drum over, and set it down on the bearing support. Be careful not to damage the seal when lowering the drum onto the bearing support.



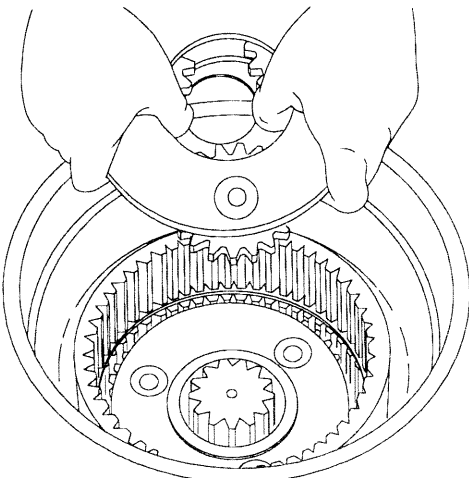
4. Lower the output planet carrier assembly into the drum, making certain that the teeth on the carrier mesh with the teeth in the drum.



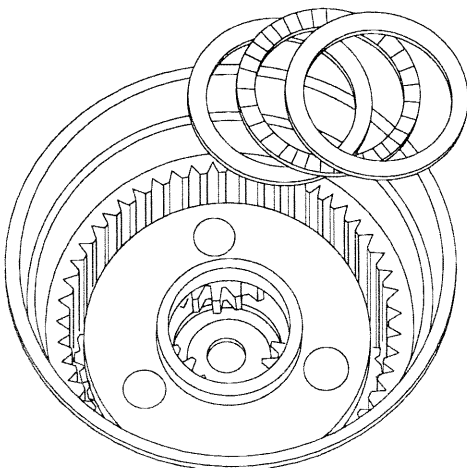
5. Install the ring gear. The ring gear teeth must mesh with the output planet gears.



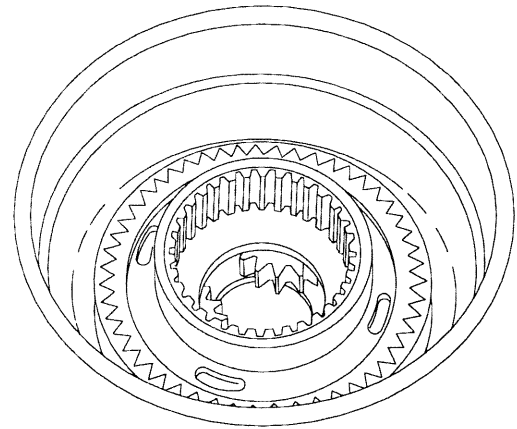
6. Install the output sun gear and the thrust washer. Center the thrust washer on the output carrier so the primary carrier pilot can be installed in it.



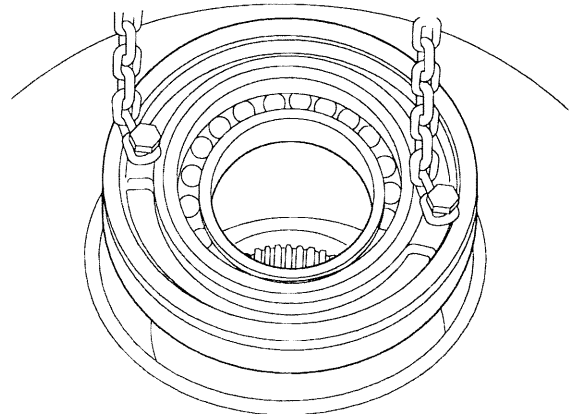
7. Install the primary planet carrier assembly in the ring gear, meshing the planet gears with the ring gear. The hub goes down, engaging the output sun gear. Be sure the pilot enters the thrust washer.



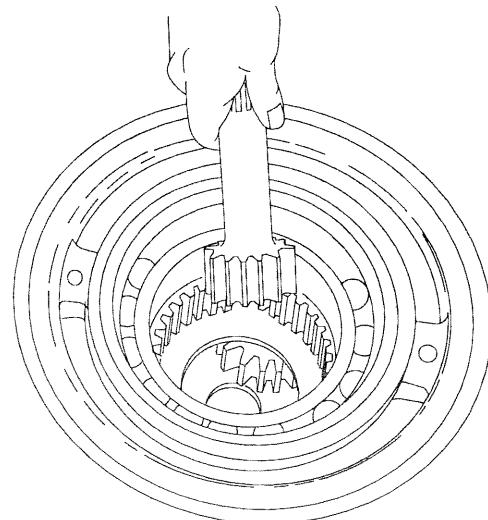
8. Install thrust bearing and two race as shown. The thinner thrust race (.063 thick) goes next to the planet carrier and the thicker thrust race (.092 thick) goes next to the ring gear adapter. The needle thrust bearing of course goes between the two races. Not all units have this design revision using the thrust washer (see Parts Breakdown for details).



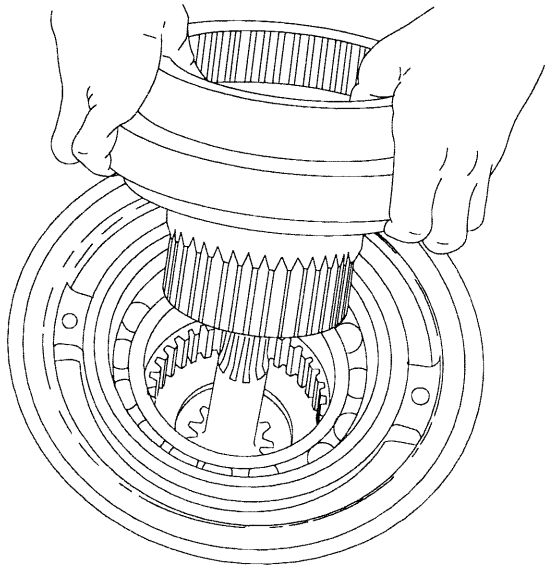
9. Install the ring gear adapter, hub end up, meshing the adapter with the ring gear.



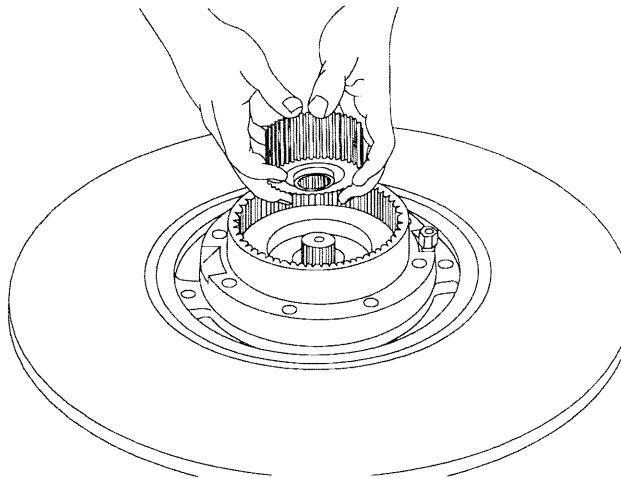
10. Install a new bearing in the drum closure if replacement is necessary, making certain to press it against the shoulder in the bottom of the bearing bore. Coat the outside diameter of the new seal with a good grade of sealant. Turn the spring side of the seal toward the bearing, and press the seal into the seal bore, leaving it flush with the surface shown. Lubricate the new O-ring and install it on the drum closure. Lubricate the large diameter on the closure and install the closure in the drum.



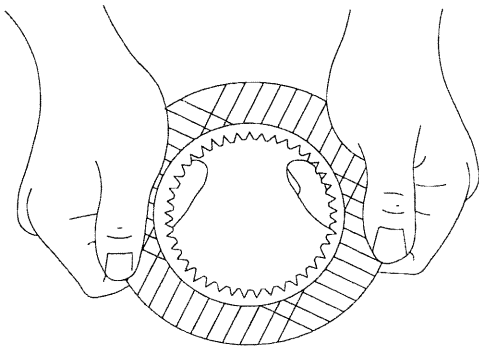
11. Install the primary sun gear, meshing its teeth with the primary planet gears.



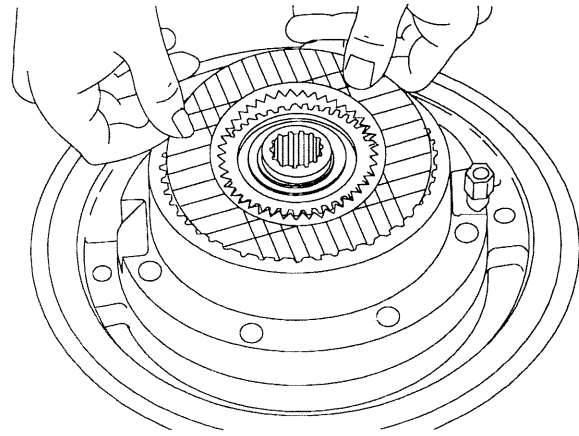
12. Install the brake cylinder assembly over the primary sun gear, making certain the brake cylinder engages the ring gear adapter teeth.



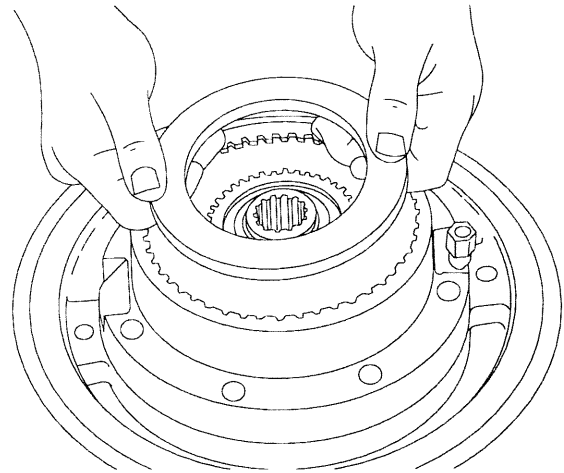
13. Install the brake clutch assembly over the primary sun gear. When installed correctly, the outer race should turn freely in the same direction as the drum turns to spool wire rope out. For most Braden assemblies, this will be clockwise as viewed from the motor end.



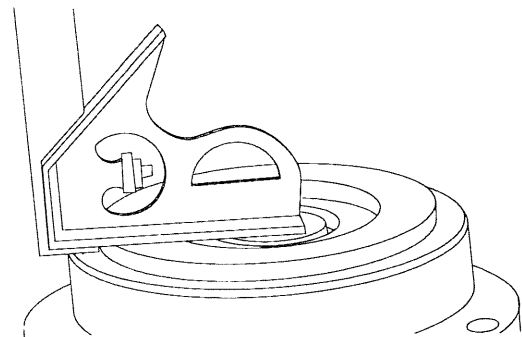
14. Before installing the brake discs and friction discs, check their condition. Both kinds of discs should be flat and their teeth should not be pointed. The friction discs should have groove in the friction material. Replace discs, if necessary.



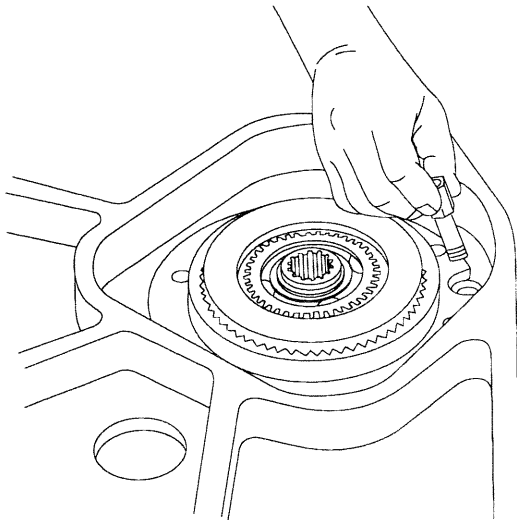
15. Install the brake discs. Start with a brake disc and end with a brake disc. Alternate brake and friction discs until there are nine (9) of the friction discs and ten (10) of the brake discs.



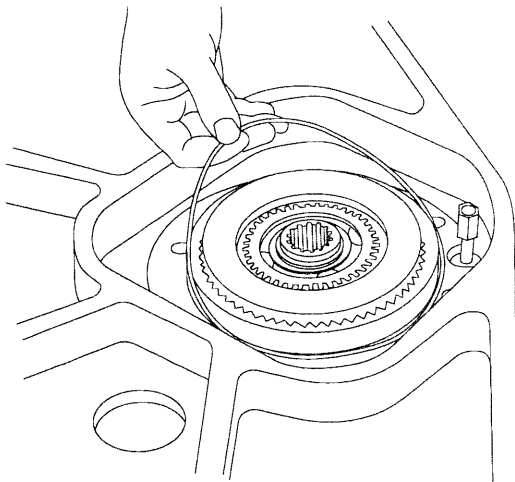
16. Install the brake plate spacer on top of the brake discs.



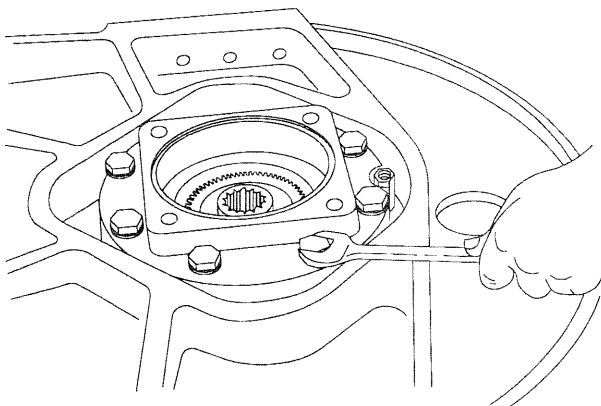
17. Measure the brake stack-up as shown. The measurement should be a minimum of $\frac{3}{16}$ " from the top of the brake plate spacer to the top of the brake cylinder. If the measurement is less than $\frac{3}{16}$ ", remove the brake plate spacer and add a brake disc to the top of the brake package. Replace the brake plate spacer and repeat procedure. Do not exceed an overall height of $\frac{1}{4}$ ".



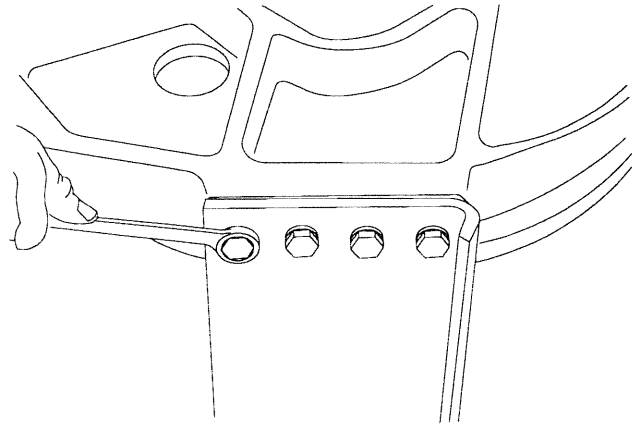
18. Install the motor end plate and then the brake cylinder nipple, using a good grade of thread sealant.



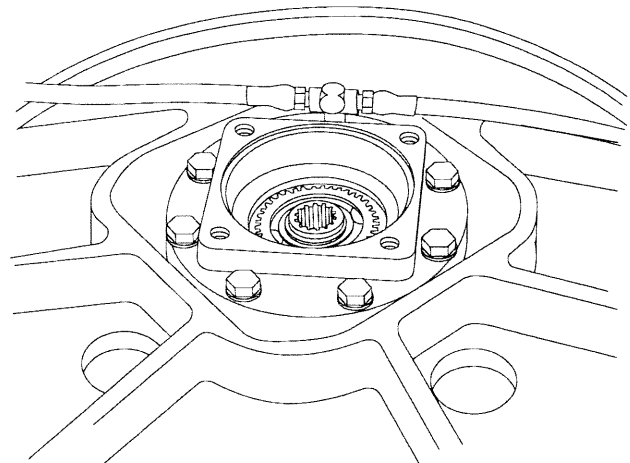
19. Lubricate the o-ring and install it on the outside of the brake cylinder. Push it down until it's resting against the motor end plate.



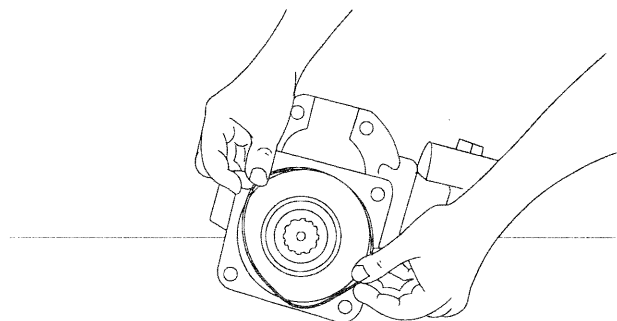
20. Install the motor adapter with eight (8) special BRADEN cap screws and lockwashers.



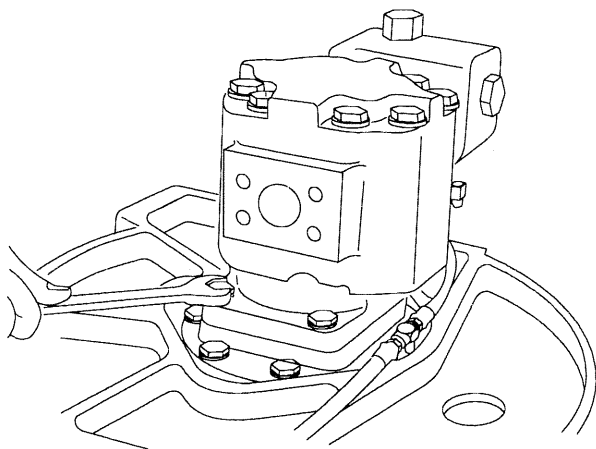
21. Install the tie plates next. Position the plates so that the curved part is toward the top of the hoist and curving away from the drum. Install the sixteen (16) cap screws and lockwashers (twenty for CH185A and C2H185A).



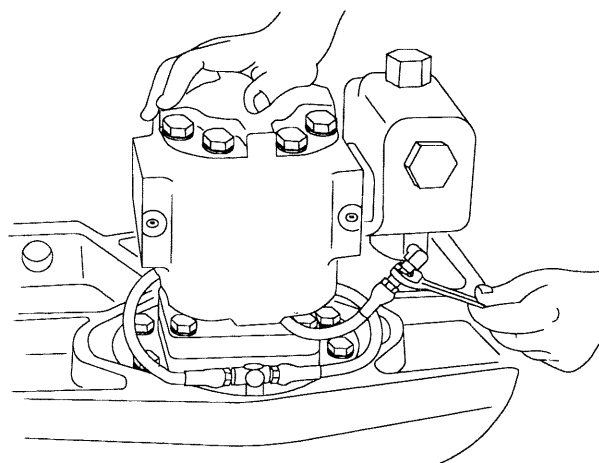
22. Install the tee and hydraulic hoses at this time. Use a good grade of thread sealant, being careful not to get it in the hydraulic lines, as it could block an orifice in the brake valve. The long hose should point to the right as viewed from the motor end.



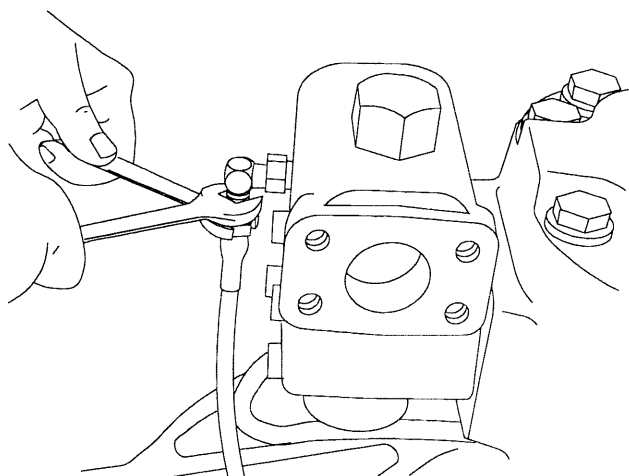
23. Lubricate and install a new O-ring around the pilot on the motor.



24. Engage the motor shaft in the brake clutch assembly inner race, and lower the motor into place. Install four (4) capscrews and lockwashers



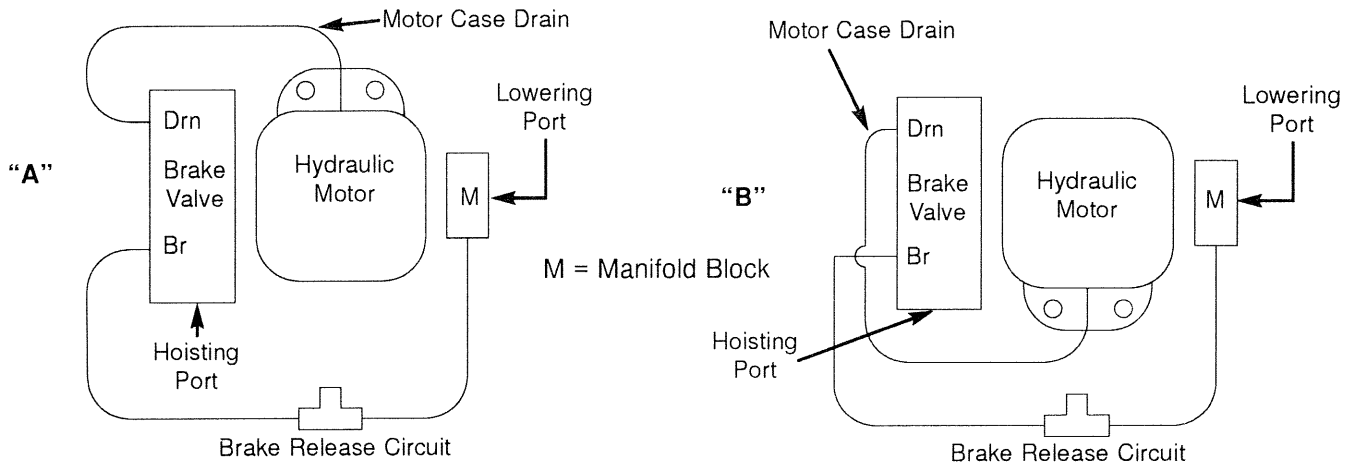
26. After the hoist assembly is complete, check all cap-screws and fittings to make certain they have been tightened correctly. Refill the hoist with the recommended oil listed under maintenance suggestions.



25. Install the hydraulic hoses as shown, then tighten. Continued on illustration no.26.

REVERSING DIRECTION OF DRUM ROTATION

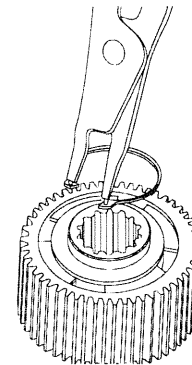
This procedure applies in general terms to standard hoists with Commercial Intertech gear motors. For information concerning hoists with other types of motors, consult the BRADEN Service Department at the phone number listed in the FOREWORD section of this manual.



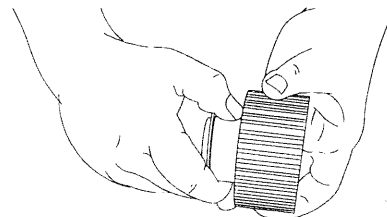
In order to change the direction of drum rotation, 2 things must be changed on the hoist. First, the motor must be made to rotate in the opposite direction. This is done by exchanging positions of the brake valve and manifold block on the motor. Secondly, the brake clutch assembly must be made effective for the opposite direction of rotation. This is done by reversing the brake clutch.

Figures "A" and "B" above show typical motor installations. Note that the only difference between the two drawings is the motor is rotated 180° (the "belly" of the motor moves to the opposite side). If the motor shaft in figure "A" rotates clockwise when the hoisting port is pressurized, the motor shaft in figure "B" will rotate counterclockwise.

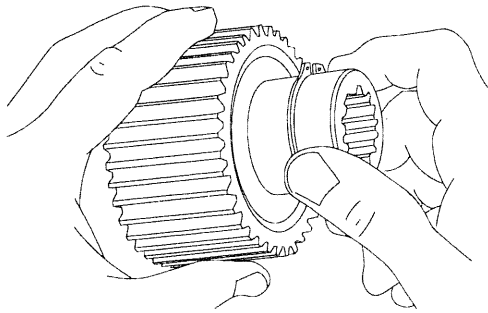
1. Stand the hoist up on the motor support with the motor up and secure in this position. Remove the four cap-screws securing the brake valve to the motor. Remove the four capscrews securing the manifold block to the motor. Disconnect the motor case drain hose at the motor. **NOTE:** Some installations have the brake release hose connected directly to the motor, instead of to the manifold block as shown above. In these cases, disconnect the brake release hose from the motor.
2. Before removing the motor, it is a good idea to mark the position of the motor in relation to the hoist, since it will be rotated 180° when re-installed. Remove the capscrews securing the motor to the hoist and carefully remove the motor.
3. Remove the brake clutch assembly from the hoist. Carefully inspect the splines on both ends of the inner race.
 - a. If they are the same, the entire brake clutch assembly can be turned over and re-installed in the hoist. **Before installing the brake clutch, be sure the inner race turns free in the same direction the drum will turn to haul-in wire rope.** An easy way to check the rotation is to hold the outer race in one hand and rotate the inner race. Proceed to step 8.
 - b. If the splines in each end of the inner race are not the same, proceed to step 4.



4. Remove the snap ring and sprag bushing retainer from one end only of the brake clutch assembly.



5. Pull the inner race out. Examine the race for scoring, wear or indentations caused by the sprag cams. If the inner race is not completely smooth, the entire brake clutch assembly must be replaced.



6. Turn the sprag assembly around and slide the inner race (with 1 snap ring and bushing retainer) through the bushing and sprag clutch (the race will have to be rotated in the free-wheeling direction to start it through the sprag clutch). Install the remaining bushing retainer and snap ring. Make sure the snap ring is properly seated in the groove.
7. Install the brake clutch assembly into the hoist.
Before installing the brake clutch, be sure the inner race turns free in the same direction the drum will turn to haul-in wire rope. An easy way to check the rotation is to hold the outer race in one hand and rotate the inner race.
8. Install a new O-ring on the motor pilot. Rotate the motor 180° from its original position and install it onto the hoist. Install and tighten motor capscrews to recommended torque.
9. Install new O-rings in the brake valve and manifold block. Attach the brake valve and manifold block to the motor using the original capscrews and tighten to recommended torque.
10. Connect the motor case drain hose to the motor case drain port. **NOTE:** On two speed motors, the case drain and shift drain ports should be connected directly to tank. DO NOT use the drain connection on the brake valve. See "TWO SPEED MOTOR CASE DRAIN PLUMBING" for additional information.
11. If your hoist had the brake release hose connected directly to the motor, the original motor port must be plugged and the hose connected to the motor pressure port near the manifold block (lowering port).
12. Operate the winch slowly in both directions and check for oil leaks and/or unusual sounds. The hoist should operate smoothly in both directions. Refer to "WIRE ROPE INSTALLATION" and properly install wire rope onto the winch drum.
13. Before returning the hoist to full service, a light load should be lifted and held a few feet off the ground to be sure the static brake is functioning properly. The winch should also be able to slowly lower the load in a controlled manner. If the winch does not perform either of these functions, refer to "TROUBLE SHOOTING" FOR ADDITIONAL INFORMATION.

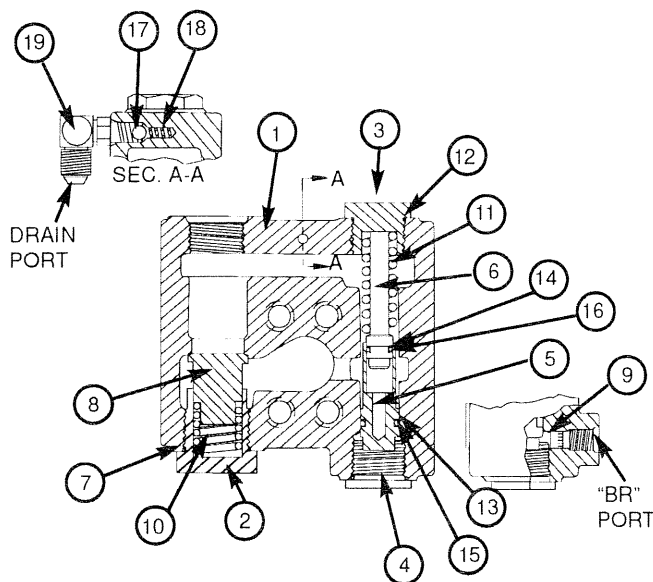
BRAKE VALVE SERVICE

Standard Braden second generation CH series hoists are supplied with one of two types of brake valves. Both are reliable hydraulic valves with internal components manufactured to close tolerances. Due to these close tolerances, several individual parts are not available as replacement parts and are noted in the following parts lists as NSS (Not Serviced Separately).

Before disassembling the brake valve, be sure you have conducted all applicable trouble shooting operations and are certain the brake valve is causing the malfunction.

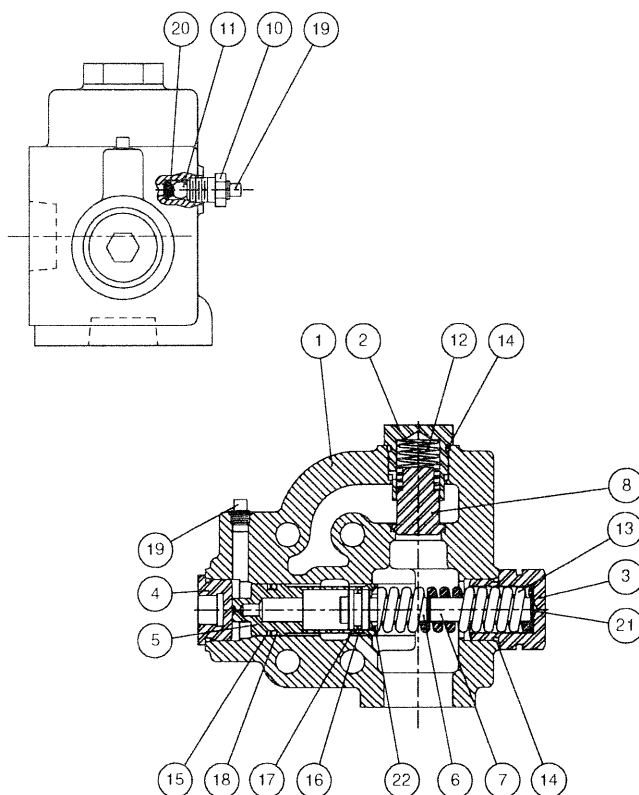
Thoroughly clean the outside surfaces of the valve and work in a clean dust-free area, as cleanliness is of utmost importance when servicing hydraulic components.

1 1/4 INCH BRAKE VALVE



ITEM	DESCRIPTION	QTY.
1	Valve Housing (NSS)	1
2	Check Valve Retainer (NSS)	1
3	Spring Retainer (NSS)	1
4	Plug (NSS)	1
5	Spool (NSS)	1
6	Damper Piston (NSS)	1
7	O-Ring	1
8	Check Valve Poppet (NSS)	1
9	Pilot Orifice	1
10	Check Valve Spring	1
11	Spool Spring	1
12	O-Ring	2
13	O-Ring	1
14	O-Ring	1
15	Back-up Ring	1
16	Back-up Ring	1
17	Check Ball (1/4 in.)	1
18	Check Ball Spring	1
19	Elbow Fitting	1

1 1/2 INCH BRAKE VALVE



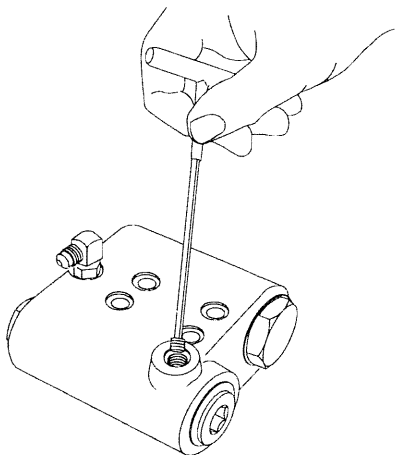
ITEM	DESCRIPTION	QTY.
1	Valve Housing (NSS)	1
2	Check Valve Retainer (NSS)	1
3	Spring Retainer (NSS)	1
4	Plug (NSS)	1
5	Spool (NSS)	1
6	Damper Piston (NSS)	1
7	Damper Piston Extension	1
8	Check Valve Poppet (NSS)	1
10	Reducer	1
11	Check Ball	1
12	Check Valve Spring	1
13	Main Piston Spring	1
14	O-Ring	1
15	Back-up Ring	1
16	O-Ring	1
17	Back-up Ring	1
18	O-Ring	1
19	Pipe Plug	1
20	Check Spring	1
21	Shim	as req'd
22	Spring Seat	1

1 1/2 inch brake valves built after mid-March 1997 contain a spring seat (item 22) between the spool spring and the spool. This provides a slightly larger, more uniform area for the spring to seat against the spool. The result is increased spring service life and improved repeatability of pressure/flow modulation over the full compression range of the spring.

The spring retainer has been modified to allow for the additional thickness of the spring seat and a groove machined into the hex end cap serves as a visual indication that the valve contains the new spring seat. The spring seat improvement may be added to earlier brake valves by installing kit, Part Number 62805. Items 3, 7, 13, 14 and 22 are included in the kit. We recommend that this kit be installed whenever the brake valve is removed for inspection or service.

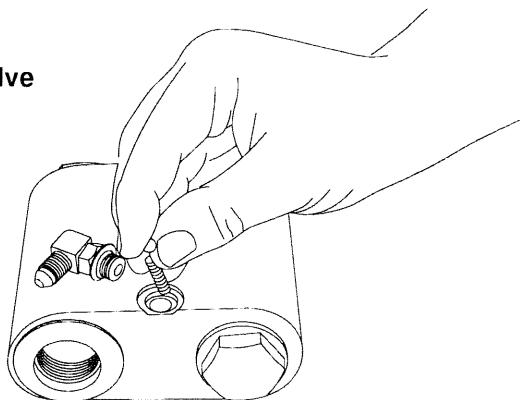
It is always a good practice to check the initial opening or "cracking" pressure of the brake valve whenever the hoist is serviced or inspected. Refer to Braden Service Bulletin 527 for complete brake valve test and adjustment procedures.

DISASSEMBLY

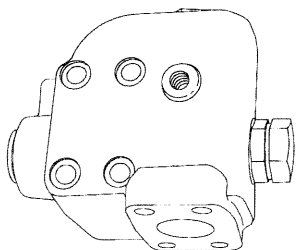


1. On the 1 1/4 inch valve only, remove the pilot orifice from the brake release (BR) port using a 5/32 inch Allen wrench

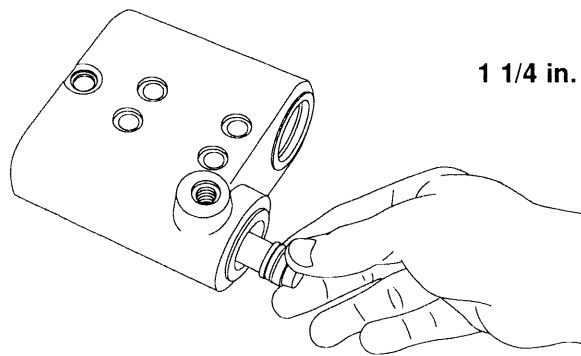
1 1/4 in. valve



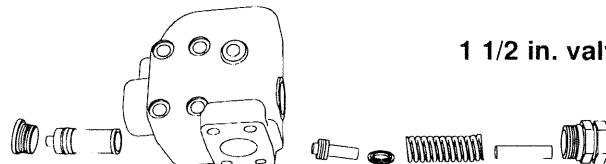
1 1/2 in. valve



2. Remove the fitting, motor drain check ball and spring.



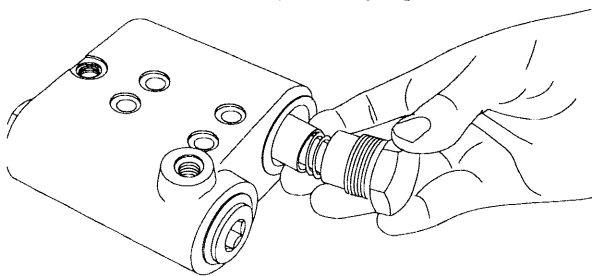
1 1/4 in. valve



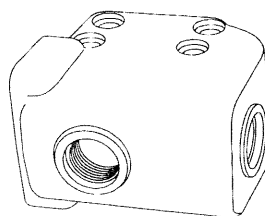
1 1/2 in. valve

3. Remove the spool spring retainer and spool spring. Remove the spool plug and carefully remove the spool assembly. Remove the damper piston from the spool. The piston will come out of the spool slowly, because of a partial vacuum formed between the two. Use extreme care to avoid damaging the polished surfaces of either piece.

1 1/4 in. valve



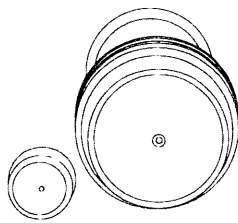
1 1/2 in. valve



4. Remove the check valve spring retainer, spring and check valve poppet.

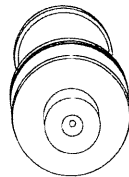
CLEAN AND INSPECT

1. Discard all O-rings and back-up rings. Clean all parts in solvent and blow dry. Inspect polished surfaces of spool and damper piston for damage that may cause binding or leakage. Inspect spool bore in valve housing for damage or scoring. Inspect check valve seat in valve housing and check valve poppet. If the spools, bores or valves are damaged, the entire brake valve must be replaced. Check the free length of main piston spring. For the 1 1/4 inch valve, replace if less than 1 15/16 in. (49.2 mm) long. For the 1 1/2 inch valve, replace if less than 3 7/16 in. (87.3 mm) long. Check the free length of the check valve spring. Replace if less than 1 1/2 in. (38.1 mm) long.



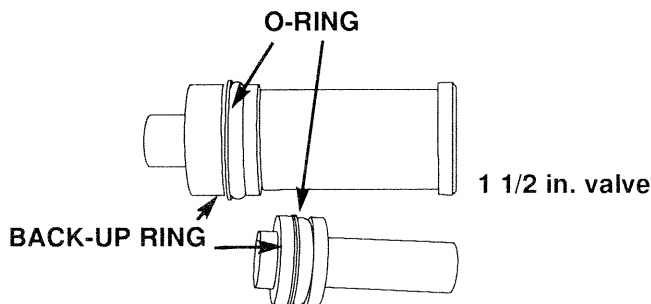
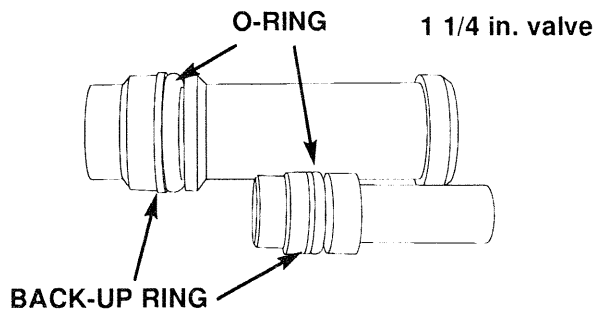
1 1/4 in. valve

1 1/2 in. valve



2. Inspect the 0.020 inch (0.5 mm) orifice in the end of the spool to be certain it is open. On the 1 1/4 in. valve, also inspect the pilot orifice to be certain it is open.

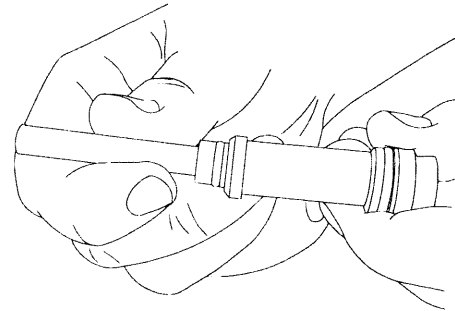
ASSEMBLY



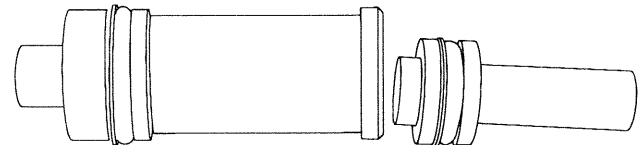
1. Install new O-rings and back-up rings on the spool and damper pistons as shown. It is important that each

back-up ring is on the correct side of its O-ring. Take care not to cut the O-rings during assembly. Let the spool and piston set for ten (10) minutes before installing them into the brake valve housing. This will allow the O-rings to return to their original size after being stretched.

2. Install new O-rings on the plug and spool retainers.



1 1/4 in. valve



1 1/2 in. valve

3. Lubricate the spool and damper piston O-rings with hydraulic oil. Carefully install the damper piston into the spool. Carefully install the spool into the valve housing. On either valve, always install the spool into the valve body from the plug end, so the O-ring enters the bore first. On the 1 1/4 inch valve, install the spool spring and spring retainer. On the 1 1/2 inch valve, install the spring seat, spool spring, damper piston extension and spring retainer.
4. Install the check valve poppet, spring and check valve retainer.
5. Install the motor drain check ball, spring and fitting.
6. On the 1 1/4 inch valve only, install the pilot orifice into the "BR" port of the valve housing.
7. The brake valve is now completely assembled and ready to be installed on the winch motor.

METRIC CONVERSION TABLE

English to Metric

Metric to English

LINEAR

inches (in.)	X 25.4	= millimeters (mm)	millimeters (mm)	X 0.3937	= inches (in.)
feet (ft.)	X 0.3048	= meters (m)	meters (m)	X 3.281	= feet (ft.)
miles (mi.)	X 1.6093	= kilometers (km)	kilometers (km)	X 0.6214	= miles (mi.)

AREA

inches ² (sq.in.)	X 645.15	= millimeters ² (mm ²)	millimeters ² (mm ²)	X 0.000155	= inches ² (sq.in.)
feet ² (sq.ft.)	X 0.0929	= meters ² (m ²)	meters ² (m ²)	X 10.764	= feet ² (sq.ft.)

VOLUME

inches ³ (cu.in.)	X 0.01639	= liters (l)	liters (l)	X 61.024	= inches ³ (cu.in.)
quarts (qts.)	X 0.94635	= liters (l)	liters (l)	X 1.0567	= quarts (qts.)
gallons (gal.)	X 3.7854	= liters (l)	liters (l)	X 0.2642	= gallon (gal.)
inches ³ (cu.in.)	X 16.39	= centimeters ³ (cc)	centimeters ³ (cc)	X 0.06102	= inches ³ (cu.in.)
feet ³ (cu.ft.)	X 28.317	= liters (l)	liters (l)	X 0.03531	= feet ³ (cu.ft.)
feet ³ (cu.ft.)	X 0.02832	= meters ³ (m ³)	meters ³ (m ³)	X 35.315	= feet ³ (cu.ft.)
fluid ounce (fl.oz.)	X 29.57	= milliliters (ml)	milliliters (ml)	X 0.03381	= fluid ounce (fl.oz.)

MASS

ounces (oz.)	X 28.35	= grams (g)	grams (g)	X 0.03527	= ounces (oz.)
pounds (lbs.)	X 0.4536	= kilograms (kg)	kilograms (kg)	X 2.2046	= pounds (lbs.)
tons (2000 lbs.)	X 907.18	= kilograms (kg)	kilograms (kg)	X 0.001102	= tons (2000 lbs.)
tons (2000 lbs.)	X 0.90718	= metric tons (t)	metric tons (t)	X 1.1023	= tons (2000 lbs.)
tons (long) (2240 lbs.)	X 1013.05	= kilograms (kg)	kilograms (kg)	X 0.000984	= tons (long) (2240 lbs.)

PRESSURE

inches Hg (60°F)	X 3600	= kilopascals (kPa)	kilopascals (kPa)	X 0.2961	= inches Hg (60°F)
pounds/sq.in. (PSI)	X 6.895	= kilopascals (kPa)	kilopascals (kPa)	X 0.145	= pounds/sq.in. (PSI)
pounds/sq.in. (PSI)	X 0.0703	= kilograms/sq.cm. (kg/cm ²)	kilograms/sq.cm. (kg/cm ²)	X 14.22	= pounds/sq.in. (PSI)
pounds/sq.in. (PSI)	X 0.069	= bars	bars	X 14.5	= pounds/sq.in. (PSI)
inches H ₂ O (60°F)	X 0.2488	= kilopascals (kPa)	kilopascals (kPa)	X 4.0193	= inches H ₂ O (60°F)
bars	X 100	= kilopascals (kPa)	kilopascals (kPa)	X 0.01	= bars

POWER

horsepower (hp)	X 0.746	= kilowatts (kW)	kilowatts (kW)	X 1.34	= horsepower (hp)
ft.-lbs./min.	X 0.0226	= watts (W)	watts (W)	X 44.25	= ft.-lbs./min.

TORQUE

pound-inches (in.-lbs.)	X 0.11298	= newton-meters (N-m)	newton-meters (N-m)	X 8.851	= pound-inches (in.-lbs.)
pound-feet (ft.-lbs.)	X 1.3558	= newton-meters (N-m)	newton-meters (N-m)	X 0.7376	= pound-feet (ft.-lbs.)
pound-feet (ft.-lbs.)	X .1383	= kilograms/meter (kg-m)	kilogram/meter (kg-m)	X 7.233	= pound-feet (ft.-lbs.)

VELOCITY

miles/hour (m/h)	X 0.11298	= kilometers/hour (km/hr)	kilometers/hour (km/hr)	X 0.6214	= miles/hour (m/h)
feet/second (ft./sec.)	X 0.3048	= meter/second (m/s)	meters/second (m/s)	X 3.281	= feet/second (ft./sec.)
feet/minute (ft./min.)	X 0.3048	= meter/minute (m/min)	meters/minute (m/min)	X 3.281	= feet/minute (ft./min.)

TEMPERATURE

$$^{\circ}\text{Celsius} = 0.556 (^{\circ}\text{F} - 32)$$

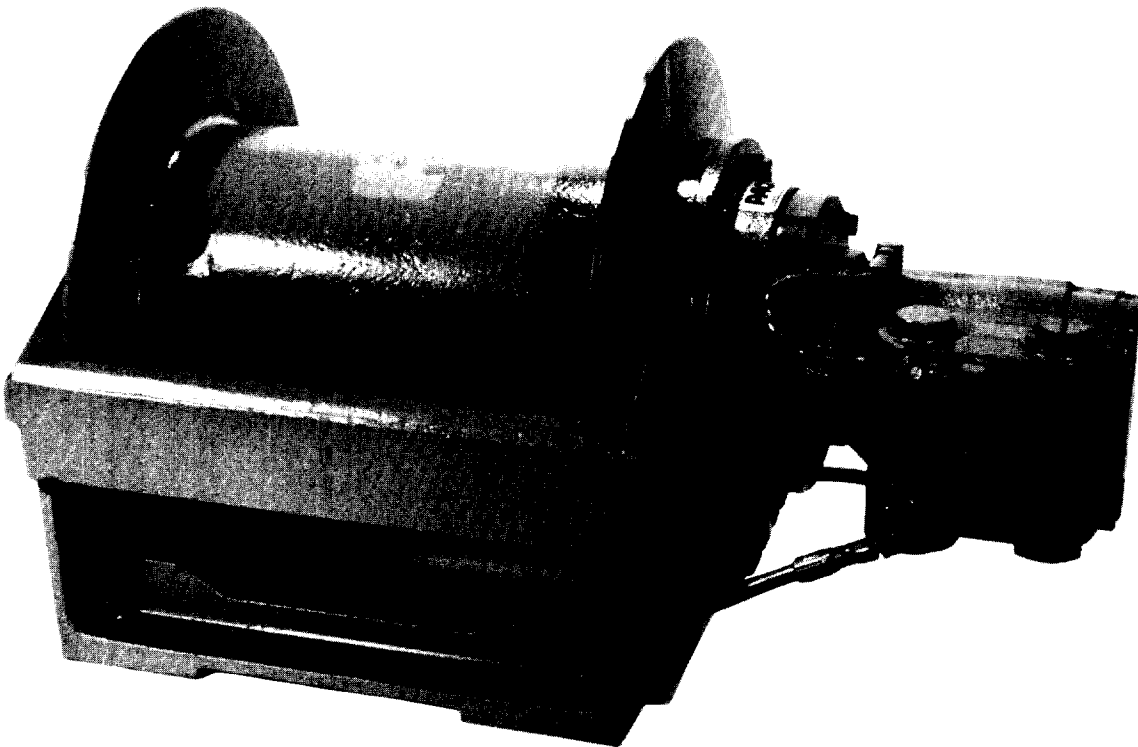
$$^{\circ}\text{Fahrenheit} = (1.8^{\circ}\text{C}) + 32$$

COMMON METRIC PREFIXES

mega	(M)	= 1,000,000 or 10 ⁶	deci	(d)	= 0.1 or 10 ⁻¹
kilo	(k)	= 1,000 or 10 ³	centi	(c)	= 0.01 or 10 ⁻²
hecto	(h)	= 100 or 10 ²	milli	(m)	= 0.001 or 10 ⁻³
deka	(da)	= 10 or 10 ¹	micro	(μ)	= 0.000.001 or 10 ⁻⁶

BRADEN[®] **Gearmatic[®]**

BG8 HYDRAULIC WINCH



INSTALLATION, MAINTENANCE AND SERVICE MANUAL

FOREWORD

Read and understand this entire manual before operating or servicing your BRADEN/GEARMATIC winch. Retain this manual for future reference.

The minimum service intervals specified are for operating hours of the prime move.

This manual contains instructions which provide installation, preventive maintenance and service information for the Model BG8 series winch. It is suggested that before doing any work on these units, all assembly and disassembly instructions should be read and understood.

Some illustrations in this manual may show details or attachments which may be different from your winch. Also, some components may be removed for illustrative purposes.

Continuing product improvement may cause changes in your winch which may not be included in this manual. When a question arises regarding your winch or this manual, contact your nearest BRADEN/GEARMATIC dealer or the factory Service Department at 1-918-251-8511, Monday – Friday, 8:00 a.m. to 4:30 p.m. CST, or by FAX at 1-918-258-4822. Provide the complete winch model and serial number when making inquiries. The model and serial numbers are stamped into the base, to the left of the hydraulic motor.

PARTS AND SERVICE

BRADEN/GEARMATIC provides parts and service through a network of authorized dealers. Parts and service are not available directly from the factory. For the name of your nearest dealer, consult your local phone directory or call us at the phone number shown above.

EXPLANATION OF MODEL NUMBER

BG	8	A	34	039	-	01	-	1
BRADEN GEARMATIC	MAX RATING	DESIGN MODEL	GEAR RATIO	MOTOR SIZE		DRUM SIZE		PERSONNEL HANDLING

BG	DESIGNATES BRADEN GEARMATIC
8	DESIGNATES 8,000 LB. FIRST LAYER LINE PULL
A	DESIGNATES THE MODEL SERIES RELATING TO DESIGN CHANGES
34	DESIGNATES TOTAL GEAR REDUCTION (23 = 23.06:1, 34 = 34.2:1; 59 = 59.06:1; 69/23 { 69.19:1 Hoist } 23.06:1 Lower }
039	DESIGNATES HYDRAULIC MOTOR DISPLACEMENT IN CU IN/REV (DECIMAL POINT ELIMINATED (039 = 3.9 CU IN/REV)
01	DESIGNATES THE DRUM
-1	PROVIDES MEANS OF TESTING BRAKE PER API 2C RECOMMENDATIONS

Refer to BG8A Material List (PB-221) for BRADEN/GEARMATIC part numbers.

Refer to GH7 H.S.R. Service Manual (PG-113) and BG8A Material List (PB-221) for high speed reverse (69/23) winches.

TABLE OF CONTENTS

GENERAL SAFETY RECOMMENDATIONS	3
THEORY OF OPERATION	4
WINCH AND WIRE ROPE INSTALLATION	6
PREVENTIVE MAINTENANCE — RECOMMENDED OIL CHANGE AND GEAR OIL INFORMATION	8
TROUBLE SHOOTING	10
WINCH ASSEMBLY	14
PLANET CARRIER SERVICE	17
MOTOR SUPPORT — BRAKE CYLINDER SERVICE	19
BRAKE CLUTCH SERVICE	23
WINCH ASSEMBLY	25
RECOMMENDED BOLT TORQUE	28

Safety and informational callouts used in this manual include:

WARNING

This emblem is used to warn against hazards and unsafe practice which COULD result in severe personal injury or death if proper procedures are not followed.

CAUTION

This emblem is used to warn against potential or unsafe practices which COULD result in personal injury, and product or property damage if proper procedures are not followed.

GENERAL SAFETY RECOMMENDATIONS

Safety for operators and ground personnel is of prime concern. Always take the necessary precautions to ensure safety to others as well as yourself. To ensure safety, the prime mover and winch must be operated with care and concern by the operator for the equipment, and a thorough knowledge of the machine's performance capabilities. The following recommendations are offered as a general safety guide. Local rules and regulations will also apply.

WARNING

Failure to obey the following safety recommendations may result in property damage, injury or death.

1. Read all warning tag information and become familiar with all controls before operating winch.
2. Never attempt to clean, oil or perform any maintenance on a machine with the engine running, unless instructed to do so in the service manual.
3. Never operate winch controls unless you are properly seated at the operators station on the prime mover and you are sure personnel are clear of the work area.
4. Assure that personnel who are responsible for hand signals are clearly visible and that the signals to be used are thoroughly understood by everyone.
5. Ground personnel should stay in view of the prime mover operator and clear of winch drum. Do not allow ground personnel near winch line under tension. A safe distance of at least 1-1/2 times the length of the cable in use should be maintained. Never allow anyone to stand under a suspended load.
6. On machines having hydraulically, mechanically and/or cable controlled equipment, be certain the equipment is either lowered to the ground or blocked securely before servicing, adjusting and/or repairing the winch. Always apply the prime mover parking brakes and lower equipment before dismounting the prime mover.
7. Inspect rigging, winch and hydraulic hoses at the beginning of each work shift. Defects should be corrected immediately.
8. Keep equipment in good operating condition. Perform scheduled servicing and adjustments listed in the "Preventive Maintenance" section of this manual.
9. An equipment warm-up procedure is recommended for all start-ups and is essential at ambient temperatures below +40°F (4°C). Refer to "Warm-Up Procedure" listed in the "Preventive Maintenance" section of this manual.
10. Be sure of equipment stability before operating winch.
11. The winches described herein are neither designed nor intended for use or application to equipment used in the lifting or moving of persons.
12. Do not exceed the maximum pressure or flow stated in the winch specifications.
13. Operate winch line speeds to match job conditions. Avoid sudden "shock" loads or attempting to "jerk" load free. This type of operation may cause heavy loads in excess of rated capacity, which may result in failure of cable and winch.
14. Leather gloves should be used when handling winch cable.
15. Never attempt to handle winch cable when the hook end is not free. Keep all parts of body and clothing clear of cable rollers, cable entry area of fairleads and winch drum.
16. When winding winch cable on the winch drum, never attempt to maintain tension by allowing winch cable to slip through hands. Always use "hand-over-hand" technique.
17. Install guarding to prevent personnel from getting any part of body or clothing caught at a point where the cable is wrapped onto the drum or drawn through fairlead guide rollers.
18. Do not weld on any part of the winch.
19. Do not use knots to secure or attach winch cable. Use correct size cable anchor for cable and pocket in winch drum.
20. Use recommended hydraulic oil and gear lubricant.
21. Keep hydraulic system clean and free from contamination at all times.
22. The BRADEN/GEARMATIC wire rope anchors are capable of supporting the rated load when installed properly. For additional safety, ALWAYS maintain a minimum of five (5) wraps of wire rope on the drum.

THEORY OF OPERATION

DESCRIPTION OF WINCH

The winch has three basic assemblies:

1. Hydraulic motor assembly and brake valve
2. Cable drum assembly
3. Brake cylinder and motor adapter

The hydraulic motor is bolted to the motor adapter which in turn is bolted to the brake cylinder and the winch base. The cable drum assembly is supported by anti-friction bearings which are located by the brake housing at one end and the bearing support at the other end. The ring gear for both planetary sets is machined on the inside surface of the cable drum.

PLANETARY GEAR TRAIN

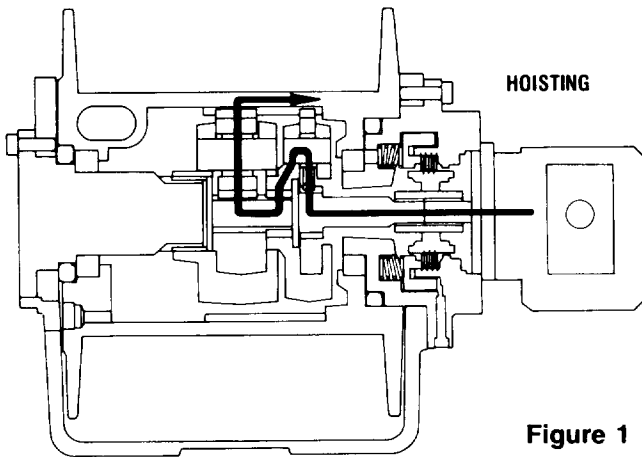


Figure 1

The hydraulic motor shaft is directly coupled to the inner brake hub which is connected to the input shaft which acts as the sun gear for the primary planetary set. When driven by the input shaft, the primary planet gears walk around the ring gear machined in the cable drum and drive the primary planet carrier.

The primary planet carrier drives the output sun gear which drives the output planet gears. The output planet carrier is splined to the bearing support and cannot rotate. As the output planet gears are driven by the output sun gear, they drive the ring gear/cable drum.

DUAL BRAKE SYSTEM

The dual brake system consists of a dynamic brake and a static brake.

The dynamic brake system has two basic components.

1. Brake valve assembly
2. Hydraulic motor

The brake valve is basically a counterbalance valve. The counterbalance valve is mounted to the hoist port of the motor on units with 020, 029 and 039 motors. Units with the 071 motor use a counterbalance valve cartridge in the brake valve block which is bolted to the motor. The operational theory of both systems is the same. A check valve allows free flow of oil to the motor in the haul-in direction and a pilot operated, spring-loaded spool valve blocks the flow of oil out of the motor when the control valve is placed in neutral. When the control valve is placed in the pay-out position, the spool valve remains closed until sufficient pilot pressure is applied to the end of the spool to shift it against spring pressure and open a passage. After the spool valve cracks open, the pilot pressure becomes flow-dependent and modulates the spool valve opening which controls the pay-out speed.

The static brake system has three basic components:

1. Spring applied, multiply friction disk brake pack
2. Over-running brake clutch assembly
3. Hydraulic brake cylinder and spring plate

The static brake consists of alternately stacked friction and steel brake disks. The steel brake disks are externally splined to the motor adapter and cannot rotate. The friction disks are internally splined to the outer brake hub of the over-running brake clutch. When compressed by spring force, the brake pack locks the over-running brake clutch outer brake hub to the motor adapter.

The static brake is released by the pilot pressure at a pressure lower than that required to open the pilot operated brake valve. This sequence assures that dynamic braking takes place in the brake valve and that little, if any, heat is absorbed by the friction brake.

The friction brake is primarily a load holding brake and will provide dynamic braking only during extremely slow operation when there is insufficient flow to open the brake valve.

The sprag type over-running brake clutch is installed between the inner brake race and the outer brake hub. The over-running brake clutch allows the inner brake race and input shaft to turn freely in the direction to haul in cable and locks up to force the friction brake disks to turn with the inner brake race and input shaft to pay out cable. The brake pack remains fully applied when hauling in cable and must be released by pilot pressure to allow the brake disks to turn freely and pay out cable.

DUAL BRAKE SYSTEM – OPERATION

When hoisting or pulling a load, the brake clutch allows free rotation of the inner brake race and input shaft. The sprag cams lay over and permit the inner brake race

to turn free of the outer brake hub. Figure 2. The friction brake remains fully engaged. The winch is not affected by any braking action during haul-in.

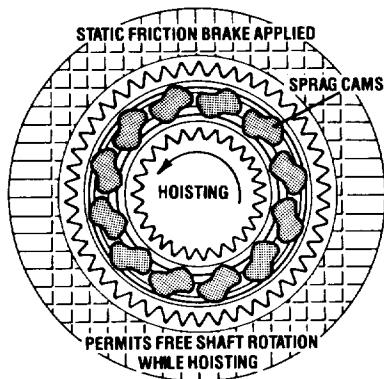


Figure 2

When the haul-in operation is stopped, the load attempts to turn the input shaft in the opposite direction. This reversed input causes the sprag cams to instantly engage and firmly lock the inner brake race to the outer brake hub. Reference Figure 3.

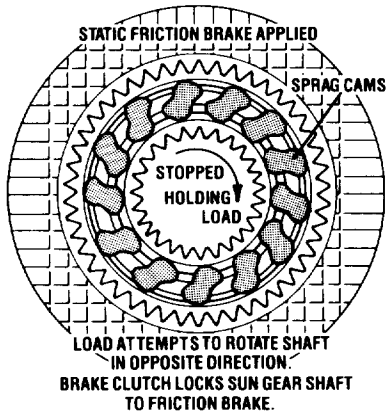


Figure 3

When the winch is powered in reverse, to pay out cable, the motor and gear train will not rotate until sufficient pilot pressure is supplied to open the brake valve. The friction brake within the winch will completely release at a pressure lower than that required to open the brake valve. The extent to which the brake valve opens will determine the amount of oil that can flow through it and the speed at which the load will be lowered. Increasing the flow of oil to the winch motor will cause the pressure to rise and the opening in the brake valve to enlarge, speeding up the descent of the load. Decreasing this flow causes the pressure to lower and the opening in the brake valve to decrease thus slowing the descent of the load.

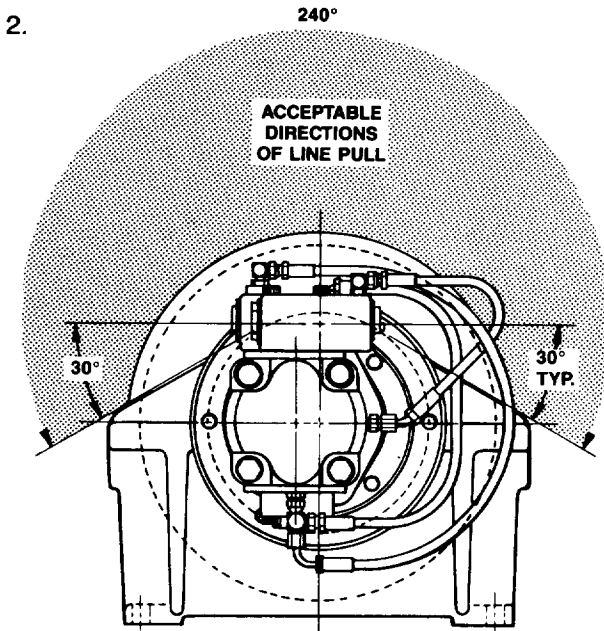
When the control valve is returned to neutral or "hold", the pilot pressure will drop and the brake valve will close, stopping the load. The friction brake will engage and hold the load after the brake valve has closed.

When lowering a load very slowly for precise positioning, no oil flow actually occurs through the winch motor. The pressure will build up to a point where the friction brake will release sufficiently to allow the load to rotate the motor through its own internal leakage. This feature results in a very slow speed and extremely accurate positioning.

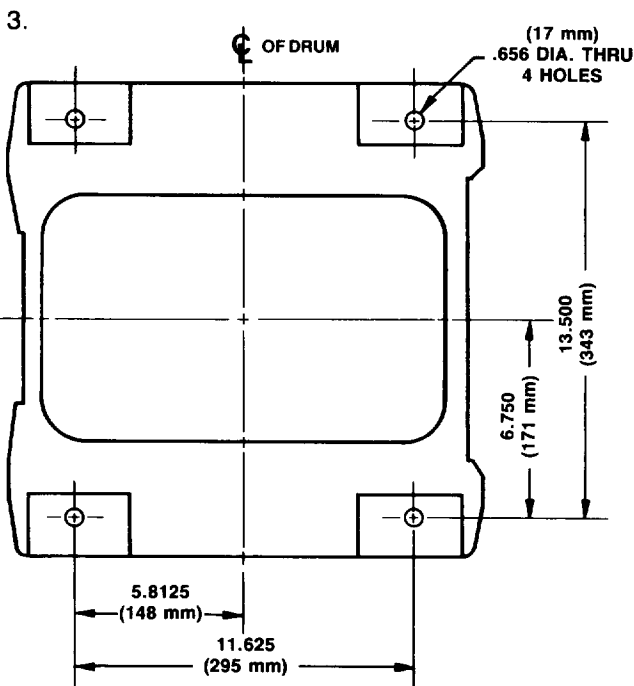
The friction brake receives very little wear in the lowering and stopping of a load. All of the heat generated by the lowering and stopping of a load is absorbed by the hydraulic oil where it can be readily dissipated.

WINCH INSTALLATION

1. The winch should be mounted with the centerline of the drum in a horizontal position. The mounting plane of the base may be rotated in any position around this centerline.

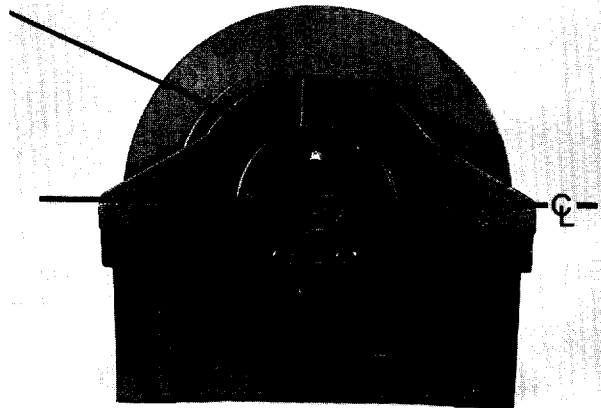


Because of the design of the mounting base, the direction of line pull should only be as shown in the above illustration. Line pulls in any other direction must be approved by BRADEN Engineering.



When mounting the winch, use all four (4) mounting holes and grade 5 (8.8) or better bolts and nuts. Tighten to recommended torque.

It is important that the winch is mounted on a surface that will not flex when the winch is in use, and cause binding of the gear train. Binding in the gear train will result in accelerated wear and heat. Also, the mounting surface should be flat within .020 in. (0.5 mm). If necessary, use shim stock to ensure even mounting.



4. The vent plug must always be located above the horizontal centerline. If the winch is mounted on a pivoting surface, be sure vent plug remains above the centerline in all positions. If necessary, reposition bearing support and vent plug as follows:

- A. Remove bearing support bolts.
- B. Rotate bearing support until vent plug is positioned correctly and bolt holes are aligned.
- C. Evenly tighten bolts to recommended torque.

5. Hydraulic lines and components that operate the winch should be of sufficient size to assure minimum back pressure at the winch. The motor manufacturer recommends that the back pressure not exceed 100 psi (690 kPa) for optimum motor seal life. 150 psi (1034 kPa) is the maximum allowable back pressure. The standard winch is supplied with the motor internally drained. If high back pressures are encountered, the motor may be externally drained directly to tank to improve motor seal life. For back pressures exceeding 150 psi (1034 kPa) consult BRADEN Service Department.

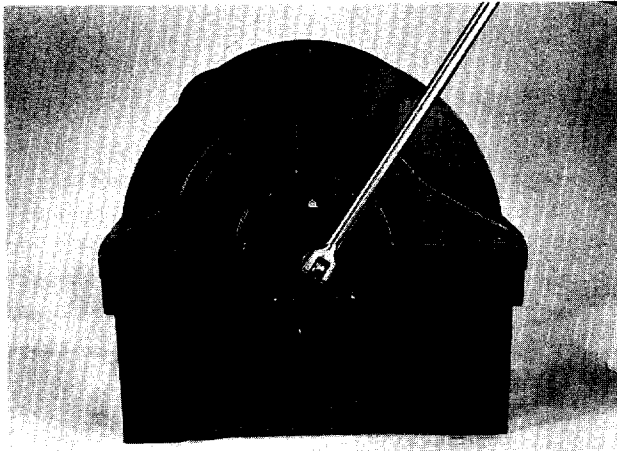
6. The winch should be mounted perpendicular to an imaginary line from the center of the drum to the first sheave to insure even spooling. Make certain the fleet angle does not exceed 1½ degrees.

PREVENTIVE MAINTENANCE

A regular program of preventive maintenance for your planetary winch will minimize the need for emergency servicing and insure long life and trouble-free service.

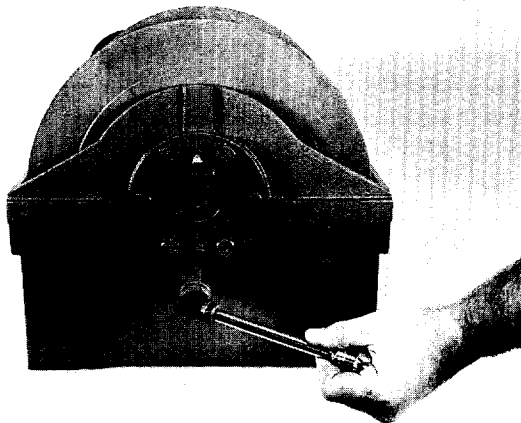
NOTE: The service intervals suggested in this manual will optimize component service life. The intervals may be gradually increased or decreased with experience of a particular lubricant and the recommendations of an independent oil analysis.

All service intervals are specified for operating hours of the prime mover.



1. Oil level

The gear oil level should be checked every 500 operating hours or three (3) months, whichever occurs first. To check the oil level, remove the large plug located in the center of the drum support. The oil should be level with the bottom of this opening. If additional oil is needed, refer to "Recommended Planetary Gear Oil".



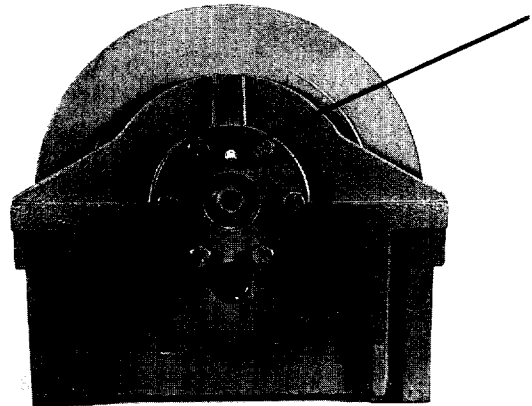
2. Oil change

The gear oil should be changed after the first one hundred (100) hours of operation, then every 1000

operating hours or six (6) months, whichever occurs first.

To drain the gear oil, align the drain plug in the drum with the hole in the support side of the base. Install a short piece of 1" pipe into the threaded drum port to prevent oil from draining onto winch base.

Insert a wrench through the 1" pipe and remove the drain plug. Install plug securely after oil has been drained. Refill with recommended planetary gear oil. Capacity is 4 U.S. pints (1.9 ltrs).



3. Vent Plug

The vent plug is located in the drum support as shown. It is very important to keep this vent clean and unobstructed. Whenever gear oil is changed, remove vent plug, clean in solvent and reinstall.

Do not paint over the vent or replace with a solid plug.

4. Hydraulic system

The original filter element should be replaced after the first fifty (50) hours of operation, then every 500 operating hours or three (3) months, or in accordance with the equipment manufacturer's recommendations.

5. Wire rope

Inspect entire length of wire rope according to wire rope manufacturers recommendations.

6. Mounting bolts

Tighten all winch base mounting bolts to recommended torque after the first one hundred (100) hours of operation, then every 1000 operating hours or six (6) months, whichever occurs first.

7. Warm-up procedure

A warm-up procedure is recommended at each start-up and is essential at ambient temperatures below +40°F (4°C).

The prime mover should be run at its lowest recommended RPM with the hydraulic winch control valve in neutral allowing sufficient time to warm up the system. The winch should then be operated at low speeds, forward and reverse, several times to prime all lines with warm hydraulic oil, and to circulate gear lubricant through the planetary gear sets.

CAUTION

Failure to properly warm up the winch, particularly under low ambient temperature conditions, may result in temporary brake slippage due to high back pressures attempting to release the brake.

8. Oil analysis

We recommend an oil analysis be conducted on

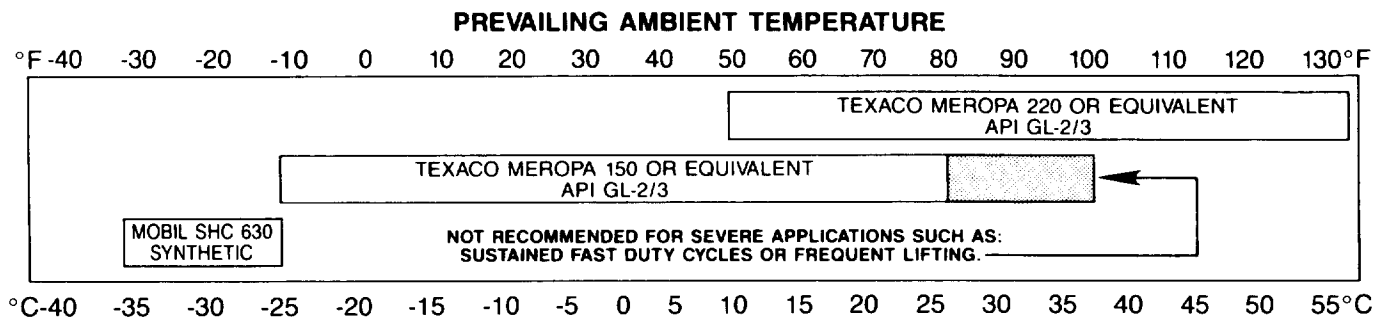
the gear oil at regular intervals. Wear metals should be monitored for early detection of problems and lubricant effectivity. In severe applications, the winch should be completely disassembled to inspect for excessive wear every 2,000 hours of operation or 12 months, whichever occurs first.

Recommended planetary gear oil

For simplicity, BRADEN has listed one (1) readily available product in each temperature range which has been tested and found to meet our specifications. This is not to say that other lubricant brands would not perform equally as well.

If the following lubricant brands are not available in your area, make certain your lubricant vendor supplies you with oil that is equivalent to those products listed below.

BRADEN planetary winches are factory filled with Texaco Meropa 150 gear oil or equivalent industrial grade gear lubricant meeting AGMA 4EP or API GL-2 with ISO viscosity grade 150. If there is still any doubt as to the suitability of a lubricant, contact the BRADEN Service Department, providing a copy of the product specification.



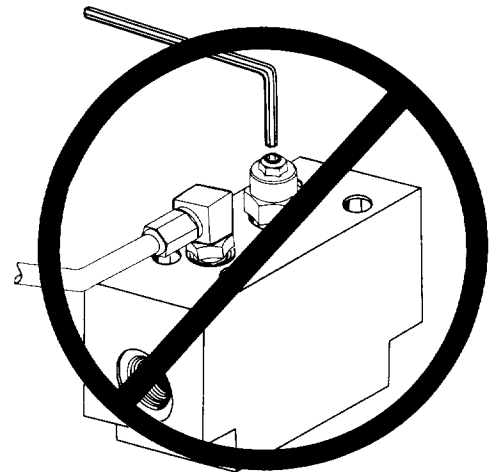
071 MOTOR

WARNING

The brake valve cartridge is factory set and normally requires no further adjustment. The brake valve can be manually piloted open by its adjusting screw. Manually opening brake valve could cause internal winch damage and may cause loss of load control during lowering operations which may result in property damage, severe personal injury or death.

The brake valve cartridge may be unique in that turning the adjustment screw in, clockwise, lowers the brake release pressure. In the event it has been determined a brake valve adjustment is required, the entire brake valve cartridge should be replaced.

The brake valve cartridge is easily removed from the brake valve block for cleaning, inspection or replacement, but is not designed to be disassembled in the field. In the event it has been determined the brake valve should be disassembled, the entire brake valve cartridge should be replaced.



TROUBLE	PROBABLE CAUSE	REMEDY
<p>A</p> <p>The winch will not lower the load or not lower the load smoothly.</p>	<p>1. The problem could be a plugged or loose pilot orifice. The pilot orifice is a small pipe plug with a hole drilled through it, located behind the pilot port fitting on the brake valve. If it becomes plugged, it will prevent the pilot pressure, from the manifold, from opening the brake valve. If it becomes loose, it will allow an unregulated amount of oil in to operate the brake valve which causes erratic brake valve operation.</p> <p>2. The friction brake may not be releasing as a result of a defective brake cylinder seal.</p> <p>NOTE: If the brake cylinder seal is defective you will usually find oil leaking from the winch vent plug.</p> <p>3. Friction brake will not release as a result of damaged brake discs.</p>	<div> </div> <p>Remove the pilot hose and fitting from the brake valve, then use a $\frac{5}{32}$ inch Allen wrench to remove the pilot orifice. The diameter of the orifice is approximately .020 inches. Clean and install the pilot orifice tightly in the brake valve.</p> <p>Check brake cylinder seal as follows:</p> <p>A. Disconnect the swivel tee from the brake release port. Connect a hand pump with accurate 0-2000 psi (0-13,800 kPa) gauge and shut-off valve to the - 4 J.I.C. fitting in the brake release port.</p> <p>B. Apply 1000 psi (6,900 kPa) to the brake. Close shut-off valve and let stand for five (5) minutes.</p> <p>C. If there is any loss of pressure in five (5) minutes, the brake cylinder should be disassembled for inspection of the sealing surfaces and replacement of the seals. Refer to "Motor Support-Brake Cylinder Service."</p> <p>Dissassemble brake to inspect brake discs. Check stack-up height as described in "Motor Support-Brake Cylinder Service".</p>

TROUBLE	PROBABLE CAUSE	REMEDY
<p style="text-align: center;">B</p> <p>Oil leaks from vent plug.</p>	<p>1. Same as A2.</p> <p>2. Motor seal may be defective as a result of high system back pressure or contaminated oil.</p>	<p>Same as A2.</p> <p>System back pressure must not exceed 150 psi (1,030 kPa). Inspect hydraulic system for a restriction in the return line from the control valve to the reservoir. Be sure control valve and plumbing is properly sized to winch motor.</p> <p>Oil analysis may indicate contamination has worn motor shaft and seal. Thoroughly flush entire hydraulic system and install new filters and oil. Install new motor seal.</p>
<p style="text-align: center;">C</p> <p>The brake will not hold a load with the control lever in neutral.</p>	<p>1. Excessive system back pressure acting on the brake release port.</p> <p>2. Friction brake will not hold due to worn or damaged brake discs.</p> <p>3. Brake clutch is slipping.</p>	<p>The same as remedy 2 of Trouble B2.</p> <p>Same as Remedy 3 of Trouble A3.</p> <p>Improper planetary gear oil may cause the brake clutch to slip. Drain old gear oil and flush winch with solvent. Thoroughly drain solvent and refill winch with recommended planetary gear oil listed in "Preventive Maintenance".</p> <p>Brake clutch may be damaged or worn. Disassemble and inspect brake clutch as described in "Brake Clutch Service".</p>
<p style="text-align: center;">D</p> <p>The winch will not hoist the rated load.</p>	<p>1. The winch may be mounted on an uneven or flexible surface which causes distortion of the winch base and binding of the gear train. Binding in the gear train will absorb horsepower needed to hoist the rated load and cause heat.</p> <p>2. System relief valve may be set too low. Relief valve needs adjustment or repair.</p>	<p>Reinforce mounting surface.</p> <p>If necessary, use shim stock to level winch. Refer to "Winch Installation".</p> <p>First loosen, then evenly retighten all winch mounting bolts to recommended torque.</p> <p>Check relief pressure as follows:</p> <p>A. Install an accurate 0-4000 psi (27,600 kPa) gauge into the inlet port of the brake valve.</p>

TROUBLE "D" CONTINUED ON NEXT PAGE

TROUBLE	PROBABLE CAUSE	REMEDY
TROUBLE "D" CONTINUED FROM PREVIOUS PAGE	<p>3. Be certain hydraulic system temperature is not more than 180 degrees F. Excessive hydraulic oil temperatures increase motor internal leakage and reduce motor performance.</p> <p>4. Winch line pull rating is based on 1st layer of wire rope.</p> <p>5. Rigging and sheaves not operating efficiently.</p>	<p>B. Apply a stall pull load on the winch while monitoring pressure.</p> <p>C. Compare gauge reading to winch specifications. Adjust relief valve as required.</p> <p>NOTE: If pressure does not increase in proportion to adjustment, relief valve may be contaminated or worn out. In either case, the relief valve may require disassembly or replacement.</p> <p>Same as remedies for Trouble D1 & D2.</p> <p>Same as remedies for Trouble E2.</p> <p>Refer to winch performance charts for additional information.</p> <p>Perform rigging service as recommended by crane manufacturer.</p>
<p>E</p> <p>The winch runs hot.</p>	<p>1. Same as D1.</p> <p>2. Be certain that the hydraulic system temperature is not more than 180°F (82°C). Excessive hydraulic oil temperatures may be caused by:</p> <p>A. Plugged heat exchanger.</p> <p>B. Too low or too high oil level in hydraulic reservoir.</p> <p>C. Same as D2.</p> <p>D. Hydraulic pump not operating efficiently.</p> <p>3. Excessively worn or damaged internal winch parts.</p>	<p>Same as remedies for Trouble D1.</p> <p>Thoroughly clean exterior and flush interior.</p> <p>Fill/drain to proper level.</p> <p>Same as remedies for Trouble D2.</p> <p>Prime mover low on horsepower or R.P.M. Tune/adjust prime mover.</p> <p>Check suction line for damage.</p> <p>If pump is belt driven, belts are slipping. Replace/tighten belts.</p> <p>Pump worn. Replace pump.</p> <p>Disassemble winch to inspect/replace worn parts.</p>

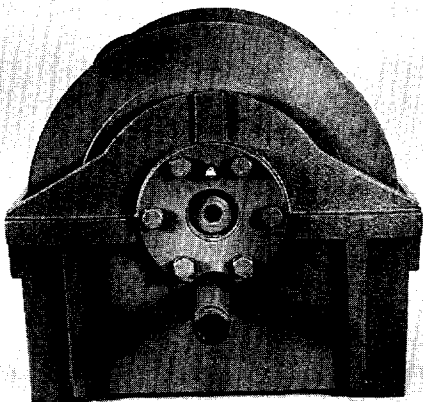
TROUBLE	PROBABLE CAUSE	REMEDY
<p style="text-align: center;">F</p> <p>Winch "chatters" while raising rated load.</p>	<ol style="list-style-type: none"> 1. Same as D2. 2. Hydraulic oil flow to motor may be too low. 3. Controls being operated too quickly. 	<p>Same as remedies for Trouble D2.</p> <p>Same as remedies for Trouble E2.</p> <p>Conduct operator training as required.</p>
<p style="text-align: center;">G</p> <p>The wire rope does not spool smoothly on the drum.</p>	<ol style="list-style-type: none"> 1. The winch may be mounted too close to the main sheave, causing the fleet angle to be more than 1½ degrees. 2. The winch may not be mounted perpendicular to an imaginary line between the center of the cable drum and the first sheave. 3. Could possibly be using the wrong lay rope. There is a distinct advantage in applying rope of the proper direction of lay. When the load is slacked off, the several coils on the drum will stay closer together and maintain an even layer. If rope of improper lay is used, the coils will spread apart each time the load is removed. Then, when winding is resumed, the rope has a tendency to criss-cross and overlap on the drum. The result is apt to be a flattened and crushed rope. 4. The winch may have been overloaded, causing permanent set in the wire rope. 	<p>Check mounting distance and fleet angle. Reposition winch as required.</p> <p>Refer to "Winch Installation".</p> <p>Consult wire rope manufacturer for recommendation of wire rope that best suits your application.</p> <p>Replace wire rope and conduct operator/rigger training as required.</p>

DISASSEMBLY OF WINCH

SERVICE PRECAUTIONS

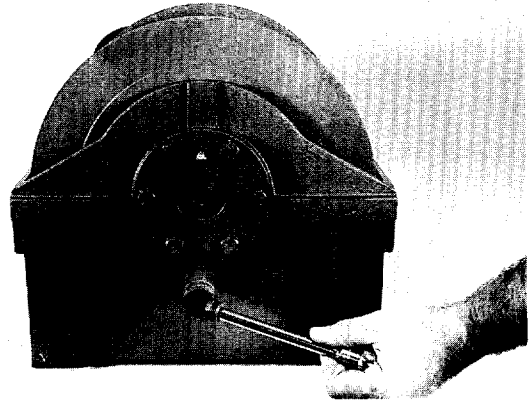
- Before any part is removed from the winch, all service instructions should be read and understood.
- Work in a clean, dust free area as cleanliness is of utmost importance when servicing hydraulic equipment.
- Inspect all replacement parts, prior to installation, to detect any damage which might have occurred in shipment.
- Use only genuine BRADEN replacement parts for optimum results. Never reuse expendable parts such as oil seals and O-rings.
- Inspect all machined surfaces for excessive wear or damage . . . before reassembly operations are begun.
- Lubricate all O-rings and oil seals with gear oil prior to installation.
- Use a sealing compound on the outside surface of oil seals and a light coat of thread sealing compound on pipe threads. Avoid getting thread compound inside parts or passages which conduct oil.
- Thoroughly clean all parts in a good grade of non-flammable safety solvent. Wear protective clothing as required.

After trouble shooting the winch and its hydraulic system as covered in the "Trouble Shooting" section, and the problem is determined to be in the winch, use the following procedure to disassemble the winch.

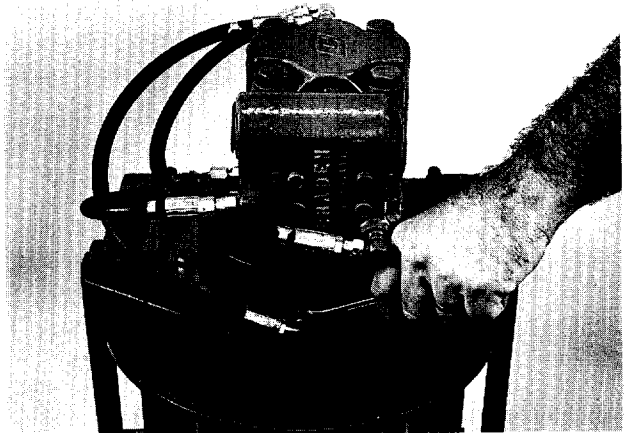


1. Remove the wire rope from the winch drum and align the drain hole in the drum with a hole in the support side plate before removing the hoses and mounting bolts. After the winch is removed from its mounting, thoroughly clean the outside surfaces. To drain the oil, install a short piece of 1 inch pipe in the larger threads of the drain hole. If necessary, insert a bar into the anchor pocket

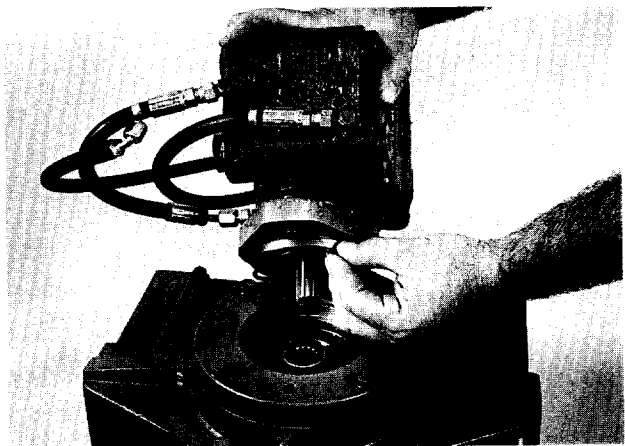
and manually rotate the drum in the direction to hoist a load until the drain holes are aligned.



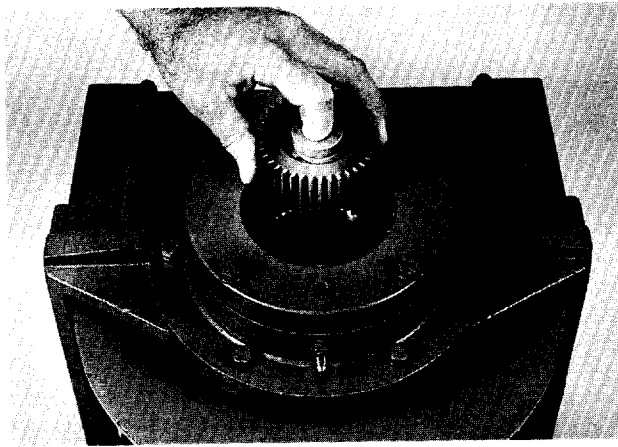
2. Remove the drain plug through the pipe.



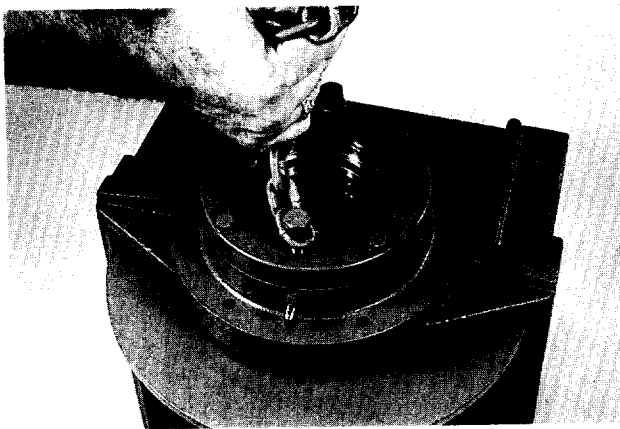
3. Begin disassembly by removing the oil level plug and standing the winch on the bearing support end. Tag and remove the hydraulic hoses that connect the brake valve and manifold to the brake cylinder release port.



4. Remove the capscrews securing the motor, and lift the motor off the winch. Remove and discard the O-ring installed on the pilot of the motor.



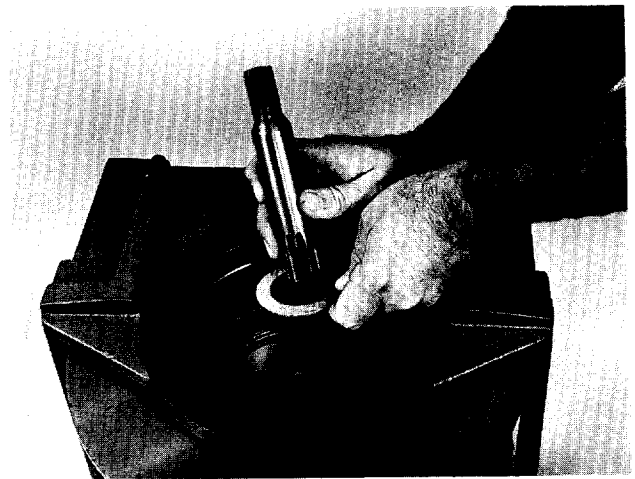
5. Remove the brake clutch assembly from the motor support. Refer to "Brake Clutch Service" for additional information.



6. Remove the brake cylinder capscrews and install two (2) capscrews and a short piece of chain into the motor mounting bolt holes. Using the chain as a handle, lift the brake cylinder assembly out of the drum and base, being careful to avoid damaging the sealing or bearing surfaces. Refer to "Motor Support — Brake Cylinder Service" for additional information.
7. Remove the drum closure. Remove and discard the O-ring from the inside of the drum.

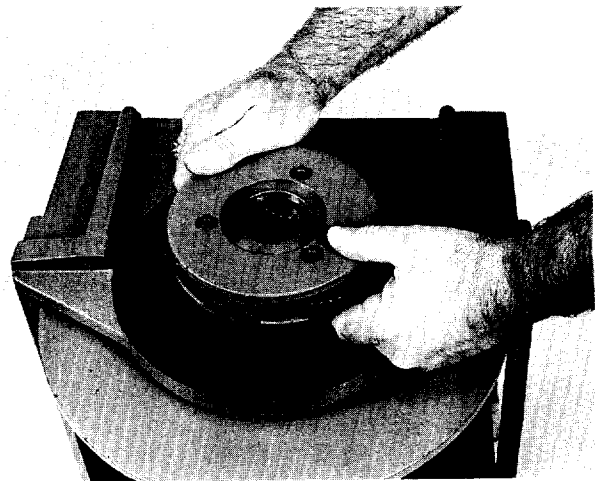


8. Remove the seal and bearing from inside of closure.

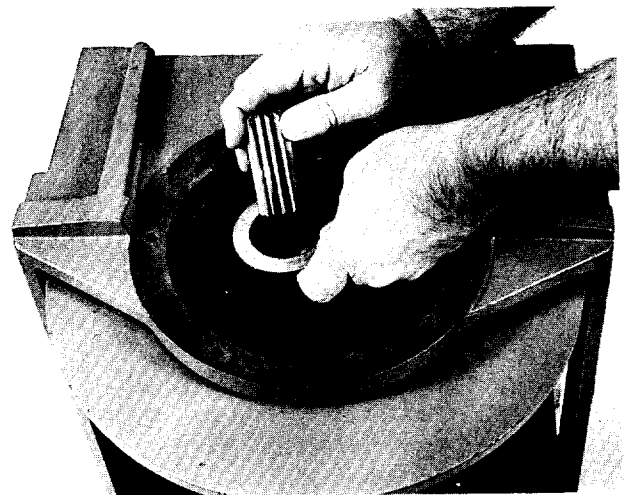


9. Remove the primary sun gear and thrust washer from the primary planet carrier.

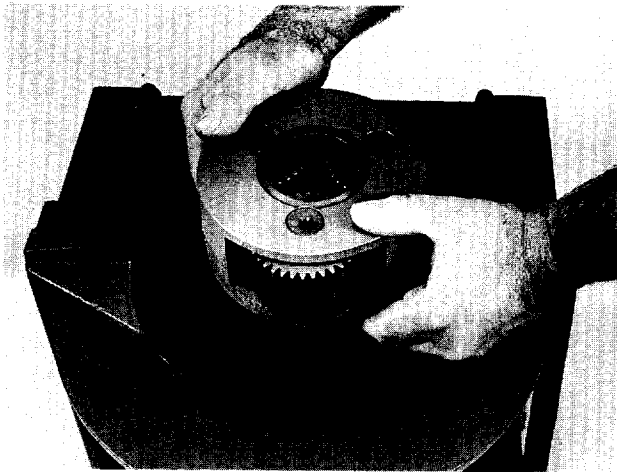
NOTE: 23:1 gear ratio winches have a sun gear adapter in addition to the sun gear shaft.



10. Remove the primary planet carrier from the drum. Refer to "Planet Carrier Service" for additional information.



11. Remove the output sun gear and thrust washer from the output planet carrier.



12. Remove the output planet carrier from the drum. Refer to "Planet Carrier Service" for additional information.



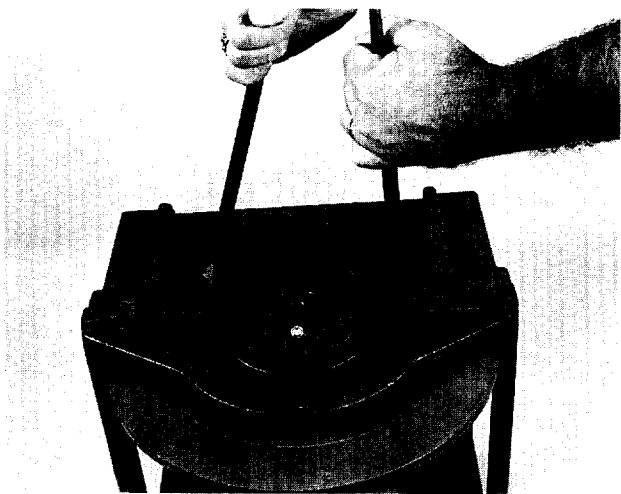
15. Slide drum out of base onto a work bench and remove seal and bearing from support end.



13. Remove snap ring from bearing support.



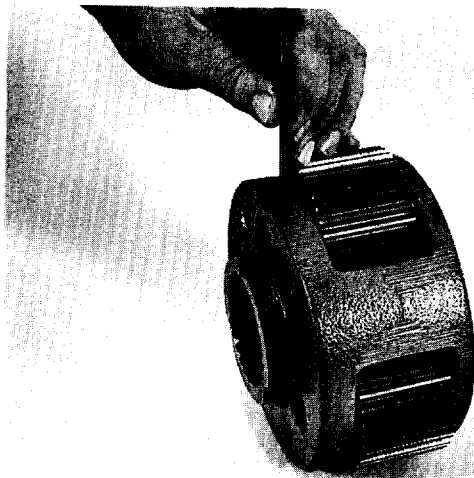
16. Thoroughly clean and inspect drum and base. Check ring gear (machined into inside surface of drum) teeth for nicks, spalling or excessive wear.



14. Stand winch on motor end with bearing support up; then remove bearing support capscrews and bearing support being careful to avoid damaging the sealing or bearing surfaces.

PLANET CARRIER SERVICE

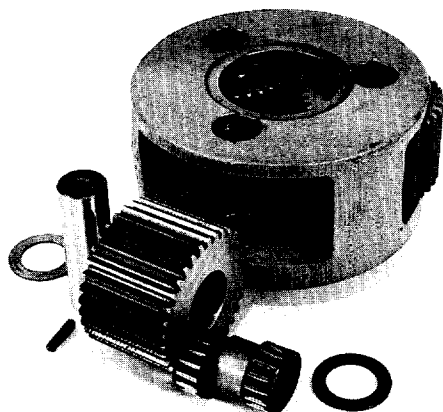
OUTPUT PLANET CARRIER DISASSEMBLY



1. Remove the planet gears by driving the roll pins into the center of the planet shafts.



2. Use a punch to drive the roll pins from the planet shafts. Do not reuse the roll pins.



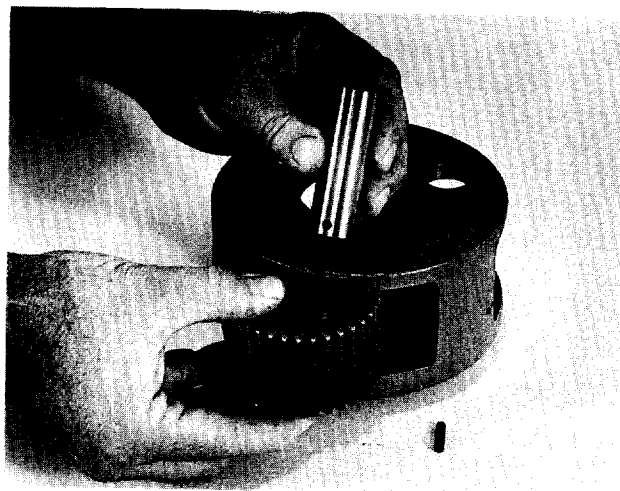
3. Now you can remove the planet shafts, bearings, spacer, thrust washers and gears. Thoroughly

clean all parts and inspect for damage and wear. The bearing rollers should not exhibit any irregularities. If the rollers show any sign of spalling, corrosion, discoloration, material displacement or abnormal wear, the bearing should be replaced. Likewise, the cage should be inspected for unusual wear or deformation, particularly the cage bars. If there is any damage that will impair the cage's ability to separate, retain and guide the rollers properly, the bearing should be replaced. The thrust washer contact areas should be free from any surface irregularities that may cause abrasions or friction. The gears and shafts should be inspected for abnormal wear or pitting. Replace if necessary.

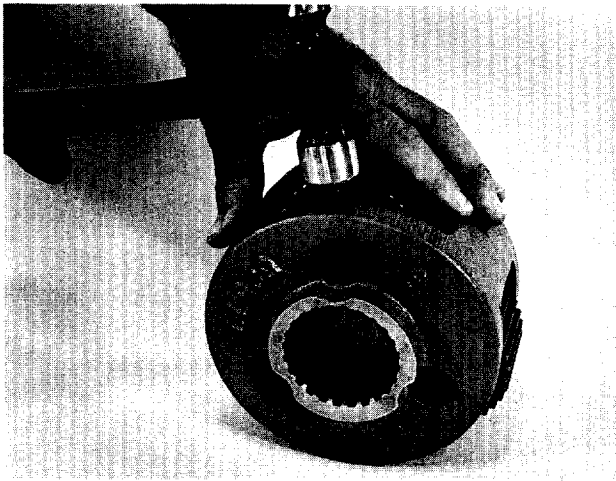
ASSEMBLY



1. Place the output planet carrier on workbench with splined coupling side down. Install output thrust plate in center of carrier.



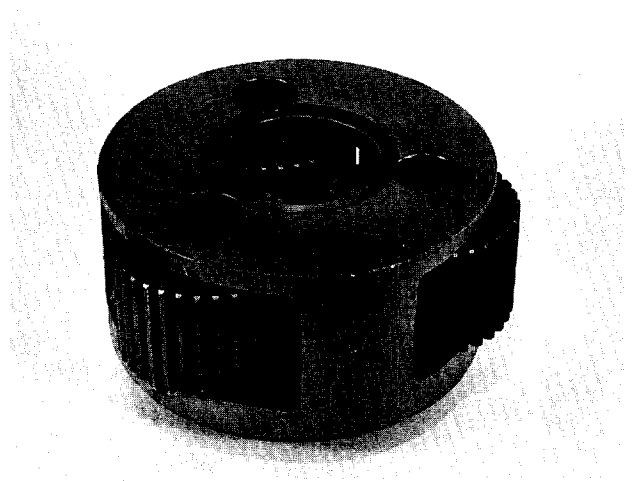
2. Insert two (2) bearings and a bearing spacer into a gear with the spacer between the bearings. Place a thrust washer on each side of the gear and position in a carrier opening. Slide the shaft through the carrier, thrust washer, bearing-gear sub-assembly and remaining thrust washer.



3. Carefully align the pin hole in the carrier with the hole in the planet gear shaft and drive the roll pin into place. Always use *NEW* roll pins.

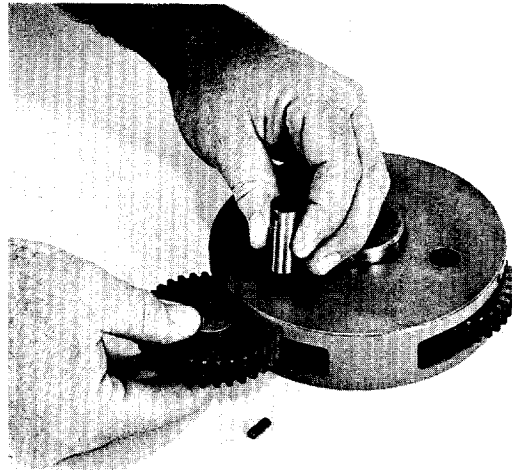


4. Note that the roll pin is slightly recessed in the carrier when properly installed. With a center punch, stake the carrier next to the pin hole as shown. This will distort the hole so the pin will not back out. Repeat these steps for each of the three planet gears.



5. Completed output planet carrier.

PRIMARY PLANET CARRIER



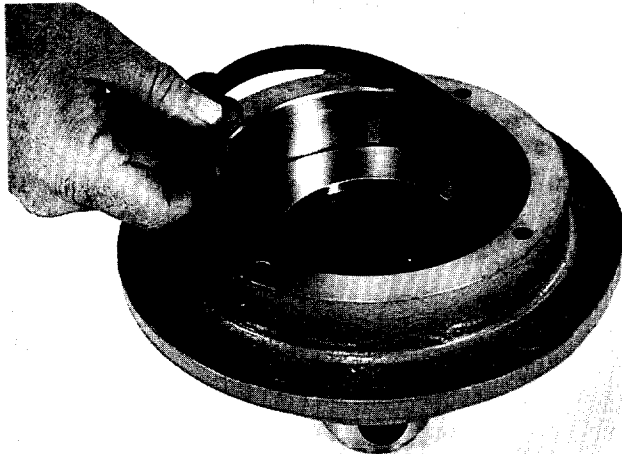
1. To service the primary planet carrier, the steps are the same as for the output carrier except there is only one bearing for each gear and no bearing spacer.

MOTOR SUPPORT-BRAKE CYLINDER SERVICE

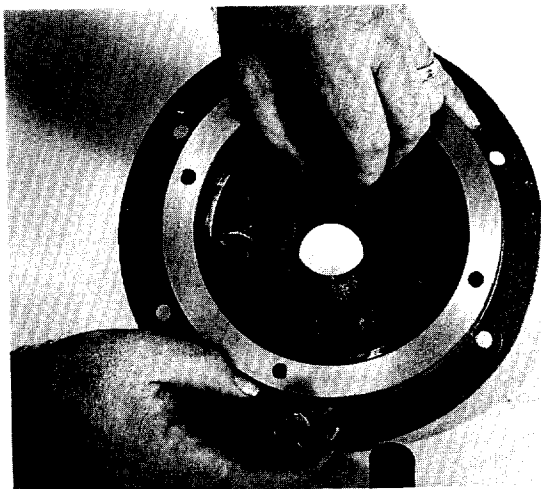
DISASSEMBLY



1. Remove the motor support capscrews then lift the motor support out of the brake cylinder. Remove the spacers, friction brake discs, and steel brake discs.

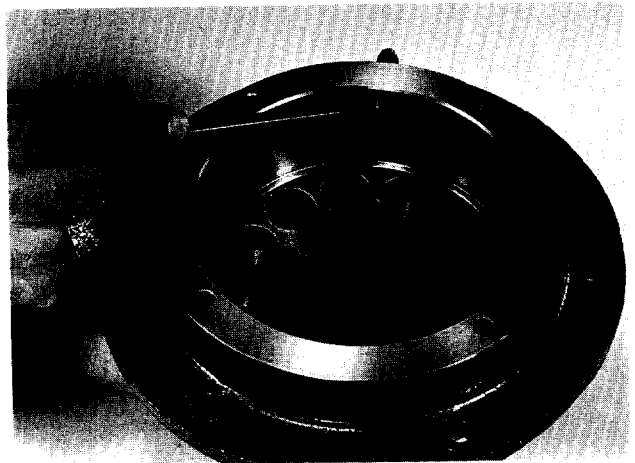


2. Remove the piston back-up ring and pressure plate.

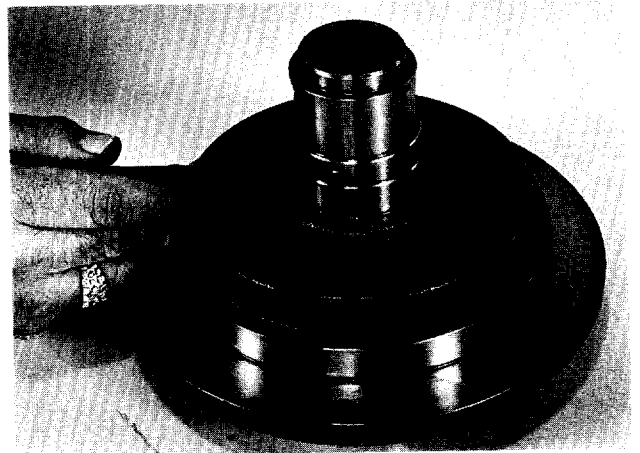


3. Remove the brake springs.

CLEAN AND INSPECT



1. Thoroughly clean and inspect all parts at this time. Check brake piston sealing surfaces on brake cylinder and motor support. Be sure brake release port is free of contamination.

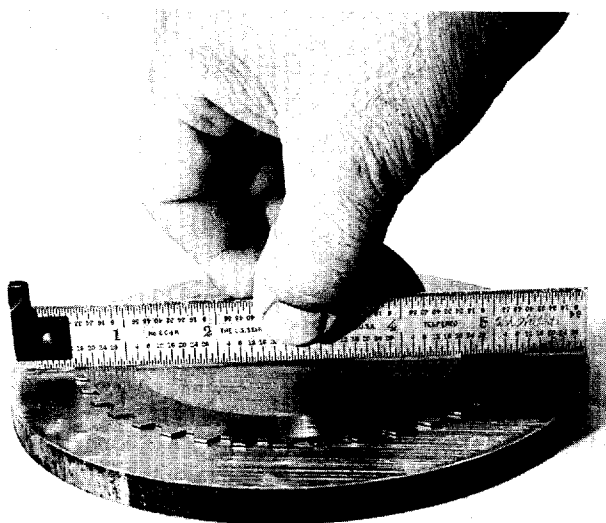


2. Check oil seal and bearing surfaces on brake cylinder for damage or wear.

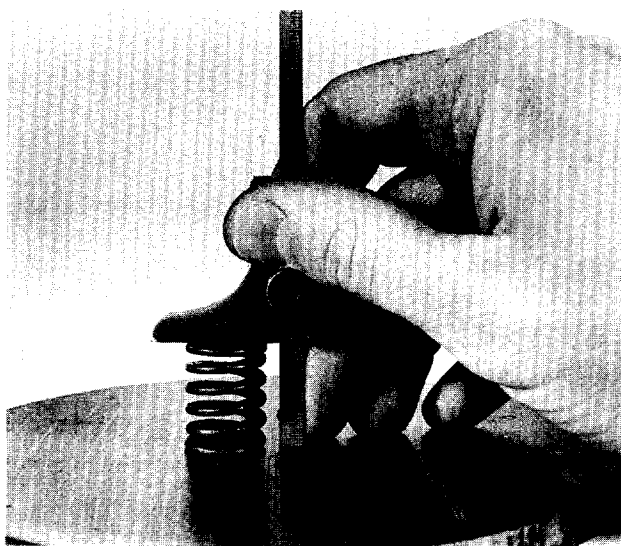


3. Place friction brake disc on flat surface and check for distortion with a straight edge. Friction material

should appear even across entire surface with groove pattern visible. Replace friction disc if splines are worn to a point, disc is distorted or friction material is worn unevenly.



4. Place steel brake disc on flat surface and check for distortion with a straight edge. Check surface for signs of material transfer or heat. Replace steel disc if splines are worn to a point, disc is distorted or heat discolored.



5. Check brake spring free length; minimum free length is $1\frac{1}{16}$ in. (30 mm). Check springs for any sign of cracking or failure. If a brake spring must be replaced for any reason, then **ALL** brake springs must be replaced.

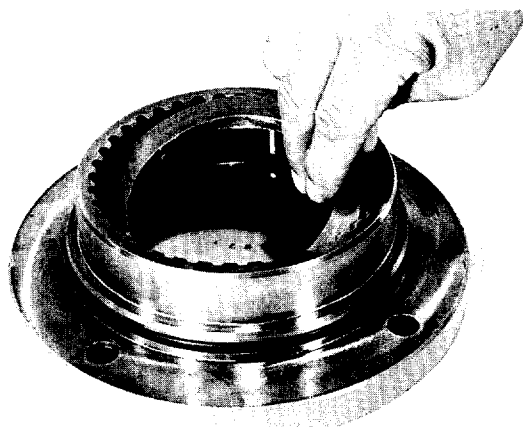
CAUTION

Failure to replace brake springs as a set may result in uneven brake application pressure and repeated brake spring failure.

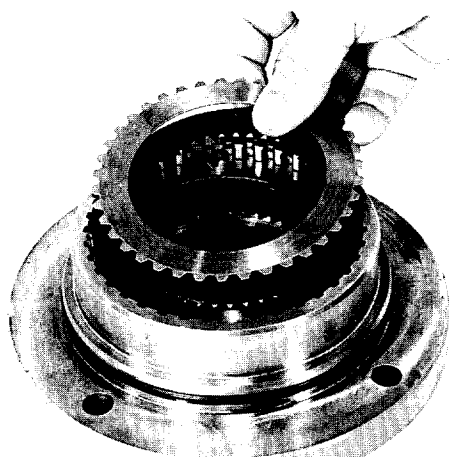
ASSEMBLY



1. Begin assembly by placing motor support on workbench with motor mounting surface down. Install new O-ring and back-up ring as shown.

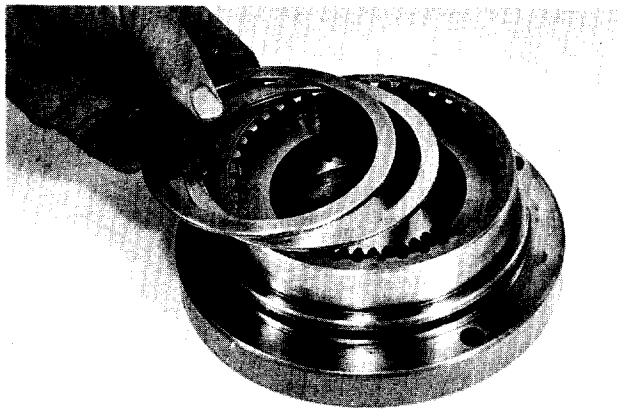


2. Install a $\frac{3}{8}$ in. (9.5 mm) thick spacer into the motor support.

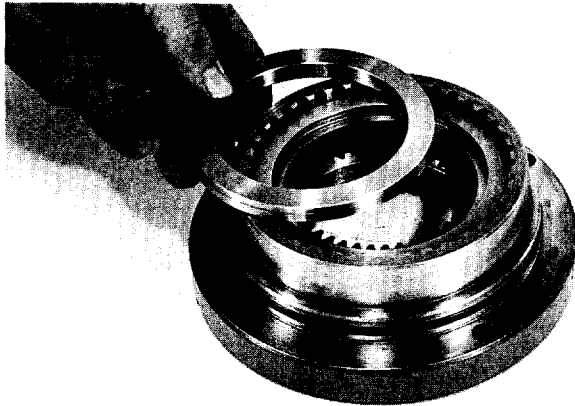


3. Insert first, a steel brake disc against the spacer followed by a friction brake disc then alternate steel and friction discs until all discs have been installed. Finish with a steel brake disc on top.

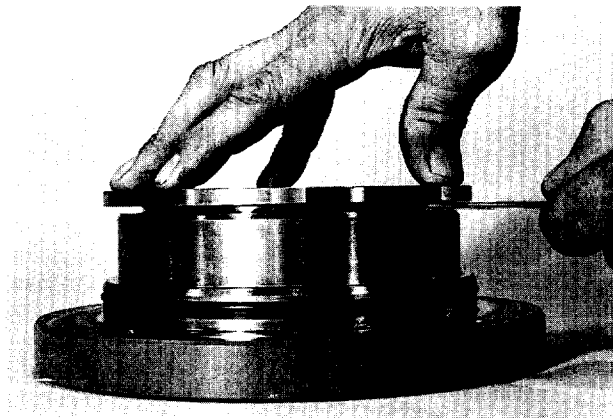
NOTE: It is good practice to pre-lubricate the discs in light motor oil prior to assembly.



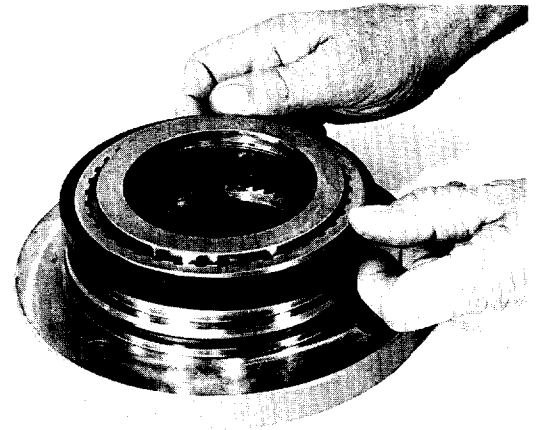
4. Install two (2) $\frac{1}{8}$ in. (3.2 mm) thick brake spacer discs on top of the last steel brake disc.



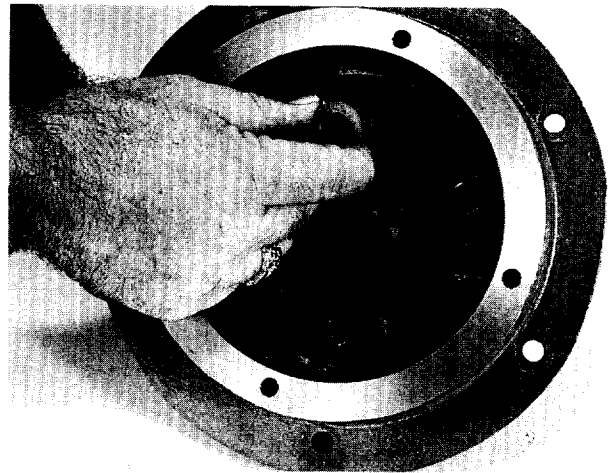
5. Install the remaining $\frac{3}{8}$ in. (9.5 mm) thick spacer on top of the brake spacer discs.



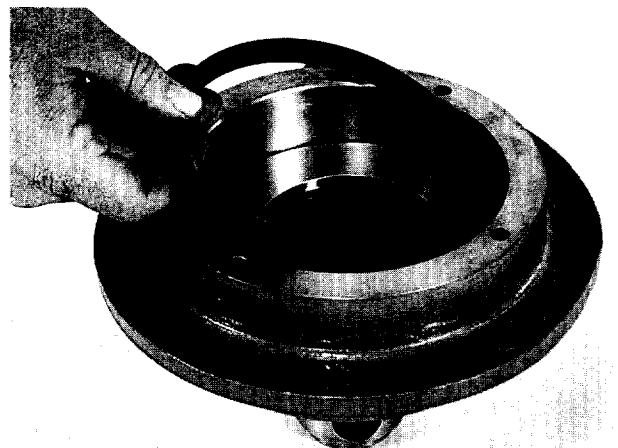
6. To check brake stack height, place pressure plate on top of brake spacer. Hold pressure plate down firmly by hand and measure clearance in three places between motor support and pressure plate. Average gap must measure between .153 in. (3.9 mm) maximum and .080 in. (2.0 mm) minimum. If the gap exceeds the maximum limit, there are too many brake discs in stack-up or the discs are distorted. If the gap is less than the minimum, there are too few discs in stack-up or the discs are worn out. When stack height is correct remove pressure plate and continue assembly.



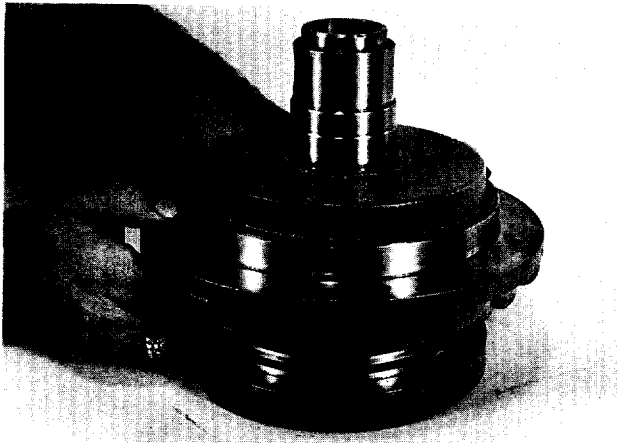
7. Lubricate the brake piston seal and motor support sealing surface with petroleum jelly or hydraulic oil. Install new piston seal on to motor support, seal lip down.



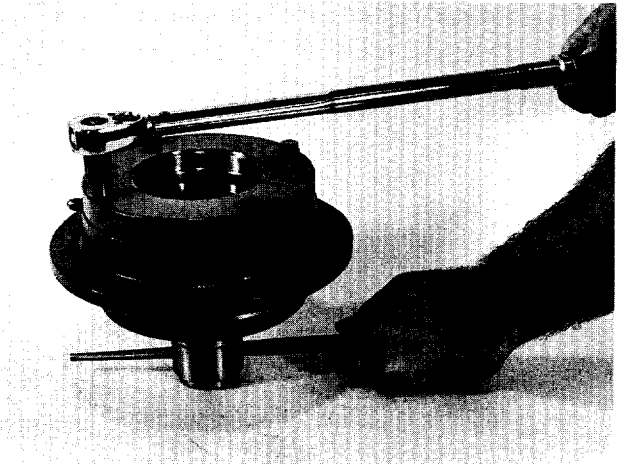
8. Install brake springs into brake cylinder.



9. Install pressure plate into brake cylinder followed by the piston back-up ring. The close-fitting piston back-up ring may be depressed slightly to one side to lodge the back-up ring in the brake cylinder bore and temporarily hold the pressure plate and springs in place while you lower the brake cylinder over the motor support.

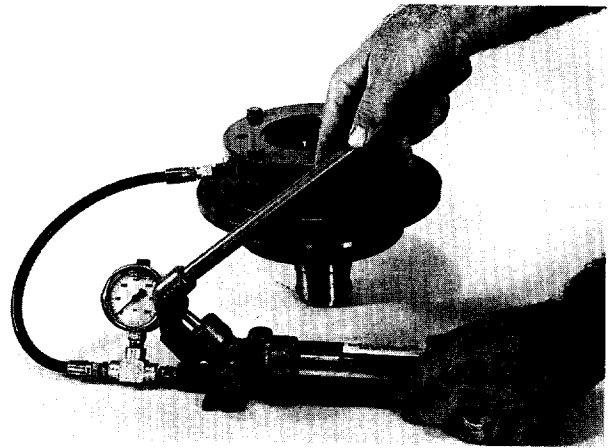


10. Apply petroleum jelly to the entire sealing surface of the brake cylinder and to the piston seal. Install the brake cylinder over the motor support being careful to avoid damaging the piston seal or motor support O-ring. (A press may be necessary to avoid cocking the brake cylinder during installation.)

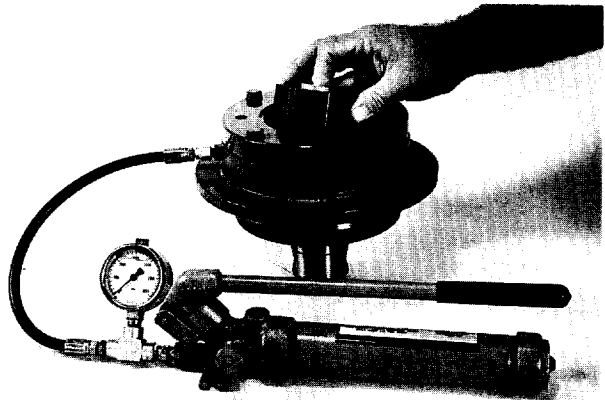


11. Install motor support capscrews and evenly tighten to recommended torque.

BRAKE CYLINDER PRESSURE TEST



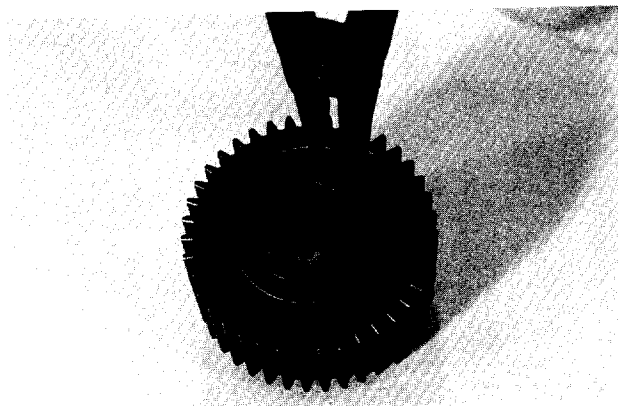
1. Install the - 4 J.I.C. fitting into the brake release port. Connect a hand pump with accurate 0-2000 psi (13,800 kPa) gauge and shut-off valve to this fitting. Apply 1,000 psi (6,900 kPa) to the brake. Close shut-off valve and let stand for five (5) minutes. If there is any loss of pressure in five (5) minutes, the brake cylinder should be disassembled for inspection of the sealing surfaces and brake piston seal.



2. WHILE PRESSURE IS APPLIED AND THE BRAKE RELEASED, install the brake clutch assembly in the brake pack. Turn the clutch back and forth as you align the outer race splines with the brake disc splines.
3. Release the pressure on the brake cylinder then remove the brake clutch assembly. The brake cylinder assembly is now complete and ready to be installed in the winch.

BRAKE CLUTCH SERVICE

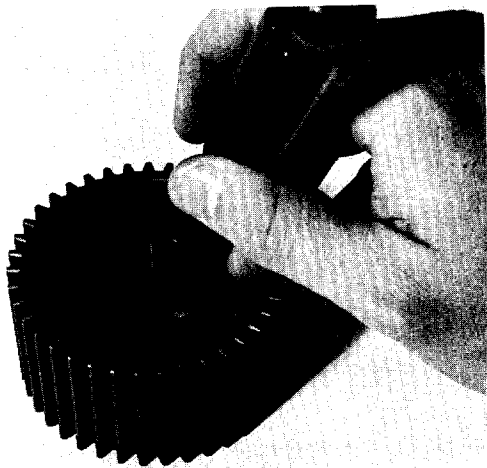
DISASSEMBLY



1. Remove the snap ring and sprag bushing retainer from one end only.



2. Pull the inner race out. Examine the race for scoring, wear or indentations caused by the sprag cams.



3. Use a screwdriver and mallet to remove the sprag bushing from one end of the outer race. There are four special cut-outs in the bushing for this purpose. Be careful not to damage the bushing inside surface. If a bushing's inside surface is damaged or shows wear, replace it.

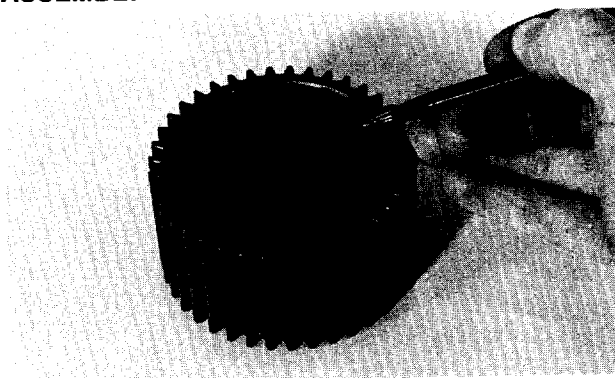


4. Next, slide the sprag clutch out, inspect the sprag clutch closely for abnormal wear, cracks, pitting, or corrosion. Check small clips for breakage or bright spots; the signs of excessive wear. Unless the outer race or remaining sprag bushing is damaged or shows excessive wear, there is no need for further disassembly. If disassembly is necessary, remove the bushing according to the procedure covered in Step No. Three (3). All brake clutch assembly parts should be thoroughly cleaned and inspected before assembly.

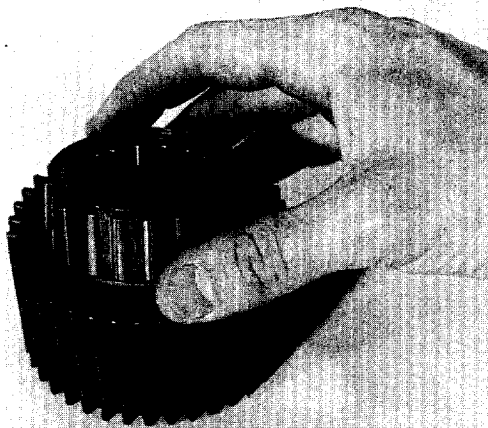
⚠ WARNING

The polished surfaces of the races and sprag cams must be perfectly smooth to insure positive engagement of the clutch. The slightest defect may reduce brake clutch effectiveness, which could result in property damage, severe personal injury or death. The entire brake clutch assembly must be replaced if inner race, outer race and/or sprag cams are defective.

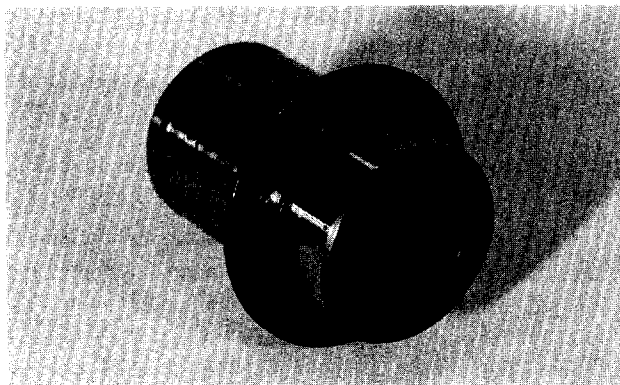
ASSEMBLY



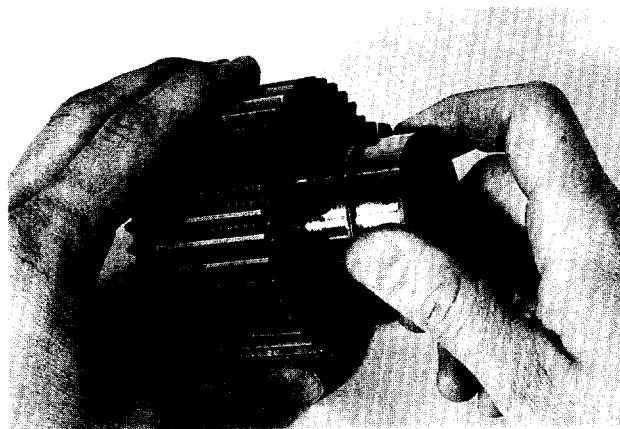
1. Press a sprag bushing into the outer race, using a mechanical or hydraulic press. A flat plate of approximately the same diameter as the bushing flange outside diameter should be placed between the press and bushing during assembly to protect the bushing. Be certain the bushing flange is against the shoulder in the outer race.



2. Turn the assembly over and install the sprag clutch in the bore of the outer race.
3. Press the remaining bushing into the race. Again, make sure the bushing is against the shoulder.



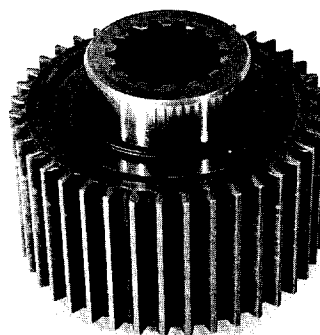
4. Next, install a sprag bushing retainer, then a snap ring on the inner race. Be sure the snap ring is seated in the snap ring groove.



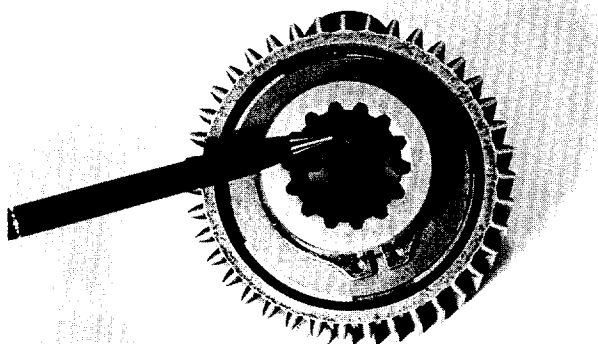
5. Slide the inner race through the bushings and sprag clutch (the race will have to be rotated in the free-wheeling direction to start it through the sprag clutch). If the inner race will not go through the bushings, the bushings have probably been damaged and should be replaced.



6. Turn the assembly over with the snap ring down. Install the second retainer and snap ring. Make certain the snap ring is seated in the groove properly.



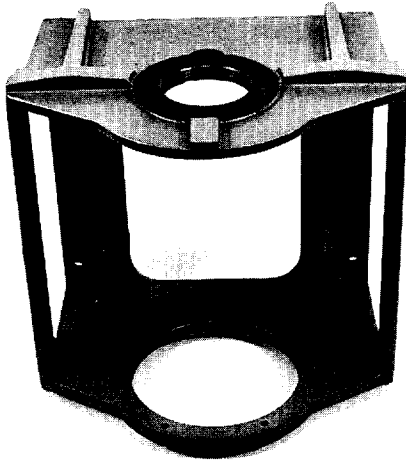
7. This is a completed brake clutch assembly.



⚠ WARNING

Be certain the snap ring is seated in the groove in the splined bore of the inner race. This snap ring will keep the brake clutch assembly correctly positioned in the center of the friction brake pack. Binding of the brake or brake failure may occur if this snap ring is omitted.

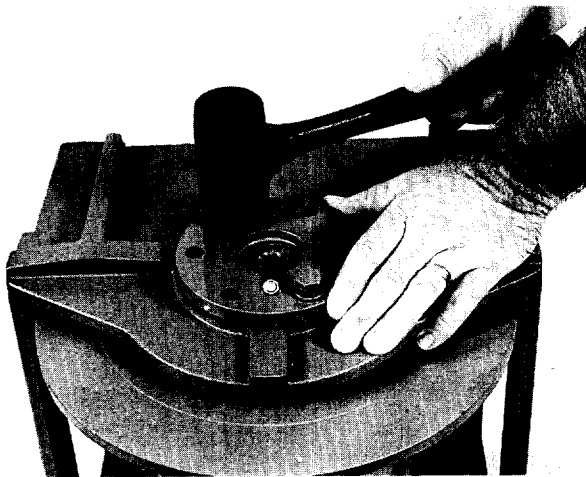
WINCH ASSEMBLY



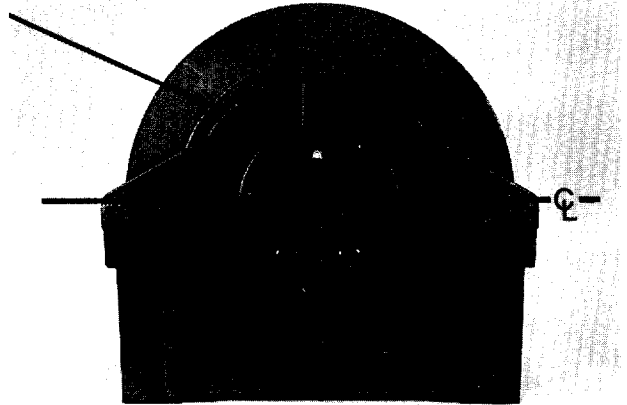
1. Place winch base on side with bearing support end up.



2. Install a new bearing in the drum if replacement is necessary. Use a good grade of sealant on the outside diameter of the new seal. Install with the spring side of the seal away from the bearing, then press into the drum, using a flat plate to avoid distortion. Be sure drain plug is installed securely.

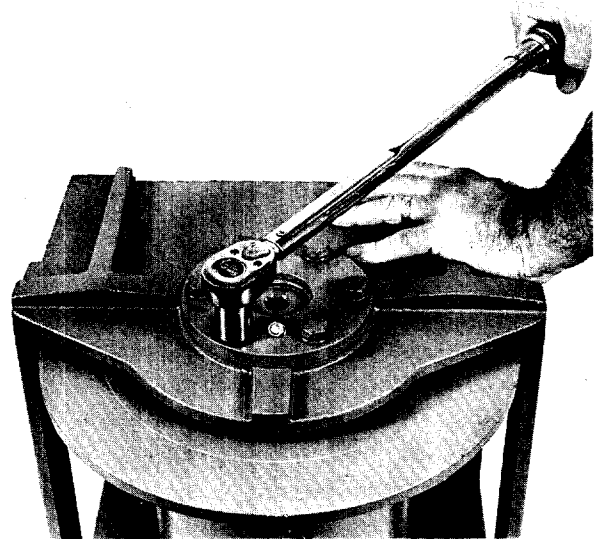


3. Center the drum in the opening of the base. Lubricate the bearing support with petroleum jelly or gear oil and install in base and drum.

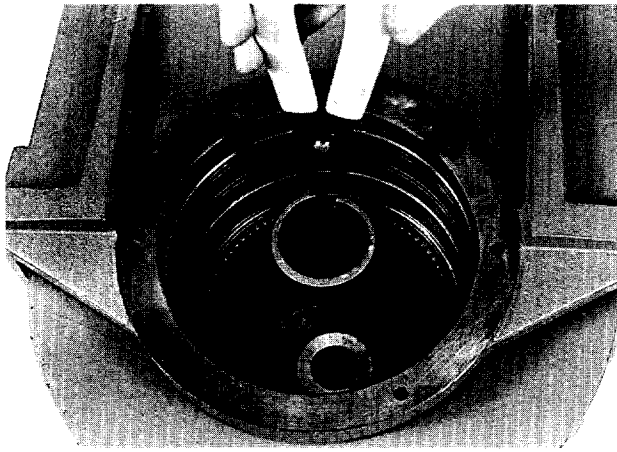


CAUTION

Be sure the vent plug is located above the horizontal centerline for the intended application. Oil leakage may occur if vent is positioned incorrectly.



4. Tighten the bearing support capscrews to the recommended torque.



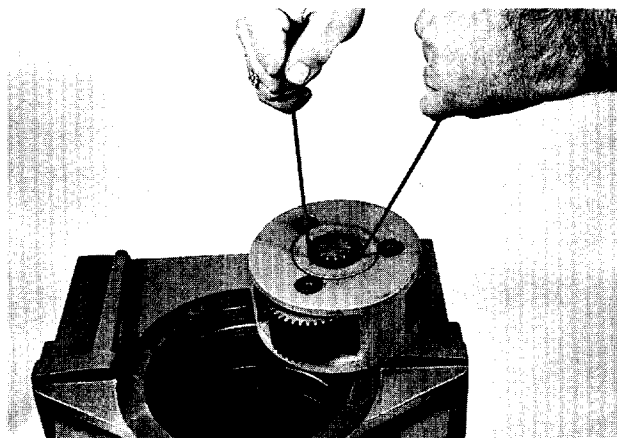
5. Stand winch on bearing support end and install snap ring on bearing support.

⚠ CAUTION

This snap ring will keep the output planet carrier correctly positioned in the winch. Gear train damage may occur if this snap ring is omitted.

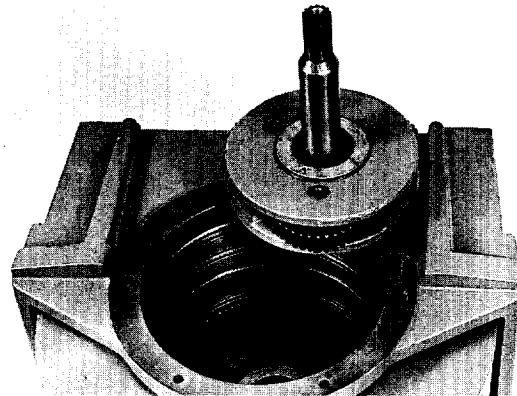


6. Install the output sun gear and thrust washer into output planet carrier.



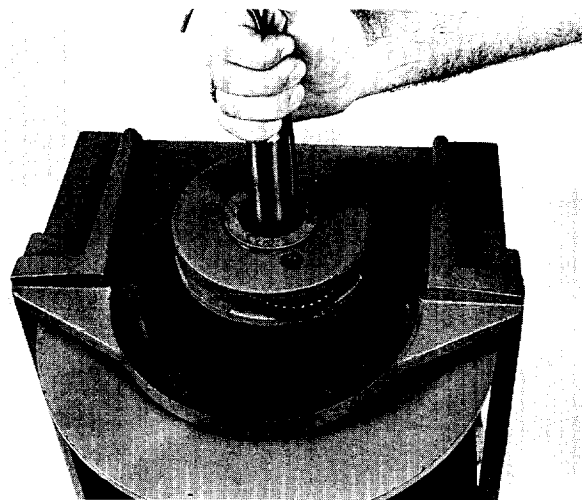
7. Install the output planet carrier into the drum while

meshing the planet gears with the ring gear and the planet housing with the bearing support.

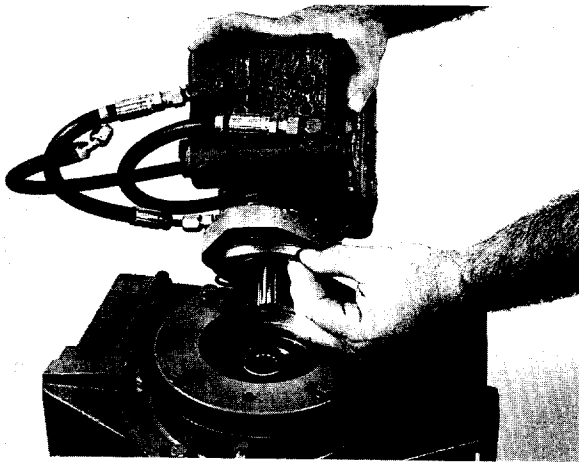


8. Install the primary sun gear and thrust washer into the primary planet carrier.

NOTE: 23:1 gear ratio winches have a sun gear adapter in addition to sun gear shaft.



9. Install the primary planet carrier, meshing the planet gears with the ring gear and the planet housing with the output sun gear.
10. Install a new bearing in the drum closure as required. Use sealant on the outside surface of the oil seal. Install with spring side of the seal away from bearing, using a flat plate to avoid distortion.
11. Install a new O-ring in the drum.
12. Lubricate the O-ring and drum opening with petroleum jelly or gear oil and install the drum closure into the drum. Install drum closure retaining ring into drum.



17. Install a new O-ring on the motor pilot then lubricate with petroleum jelly or gear oil. Engage the motor shaft with the brake clutch cam and lower motor into place. Tighten capscrews to recommended torque.

18. Install the hoses and fittings to the brake cylinder release port, manifold and brake valve.
19. After the winch assembly is complete, check all capscrews and fittings to make certain they have been tightened correctly.

Refill the winch with the recommended oil listed under "Preventive Maintenance", and install the oil level plug.

RECOMMENDED FASTENER TORQUE

The general purpose torque shown in the chart applies to SAE Grade 5 bolts, studs and standard steel full, thick and high nuts.

Higher or lower torques for special applications will be specified such as the use of spanner nuts, nuts on shaft ends, jam nuts and where distortion of parts or gaskets is critical.

Lubricated Torque values based on use of SAE 30wt engine oil applied to threads and face of bolt or nut.

Avoid using thread lubricants as the applied torque may vary by 10-40% depending upon product used.

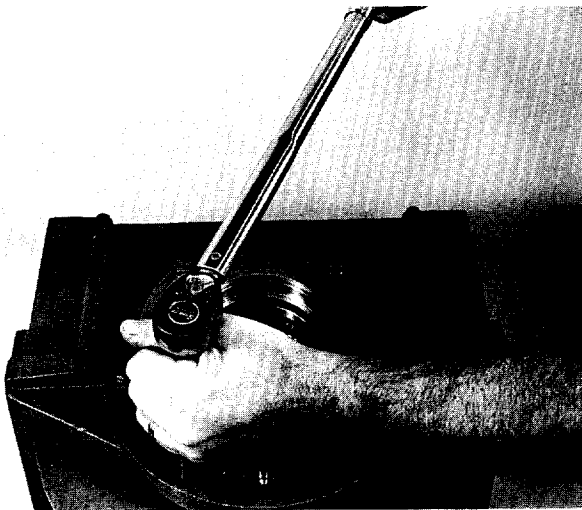
BOLT DIA. INCHES	THD PER INCH	TORQUE LB-FT. (N·m)	
		DRY	LUBED
1/4	20 28	9 (12)	6 (8)
5/16	18 24	18 (24)	13 (18)
3/8	16 24	31 (42)	23 (31)
7/16	14 20	50 (68)	37 (50)
1/2	13 20	75 (102)	55 (75)
9/16	12 18	110 (149)	80 (109)
5/8	11 18	150 (203)	115 (156)

BOLT DIA. INCHES	THD PER INCH	TORQUE LB-FT. (N·m)	
		DRY	LUBED
3/4	10 16	265 (359)	200 (271)
7/8	9 14	420 (569)	325 (441)
1	8 14	640 (868)	485 (658)
1 1/8	7 12	790 (1071)	590 (800)
1 1/4	7 12	1110 (1505)	835 (1132)
1 3/8	6 12	1460 (1980)	1095 (1485)
1 1/2	6 12	1940 (2630)	1455 (1973)

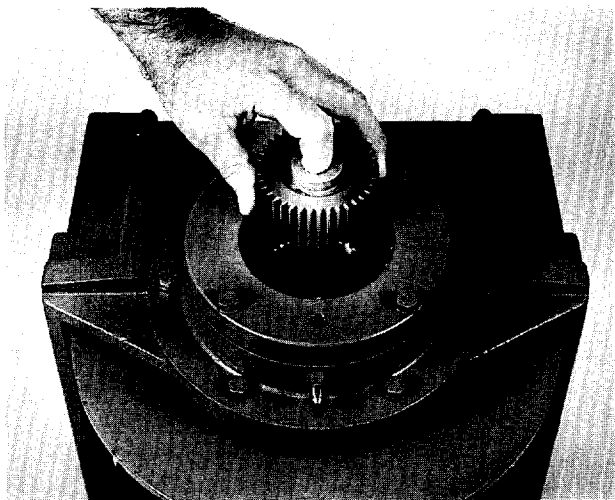
To convert lb. ft. to kg·m, multiply lb. ft. value by 0.1383.



13. Lubricate the pilot, oil seal and bearing surfaces of the brake cylinder and carefully install brake cylinder into base and drum.

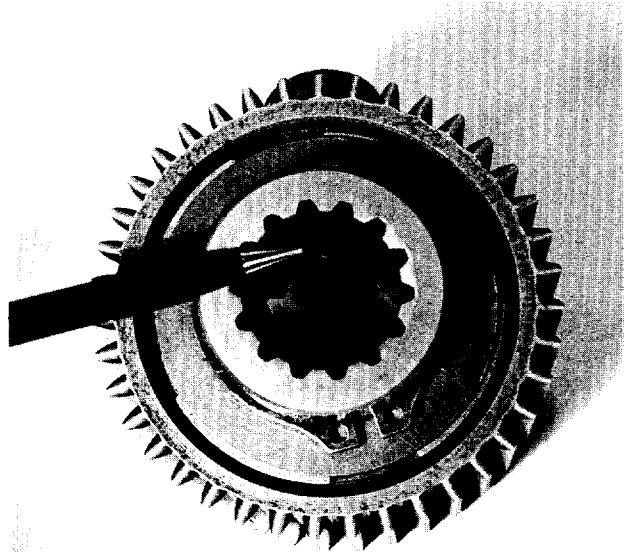


14. Tighten brake cylinder cap screws to recommended torque.



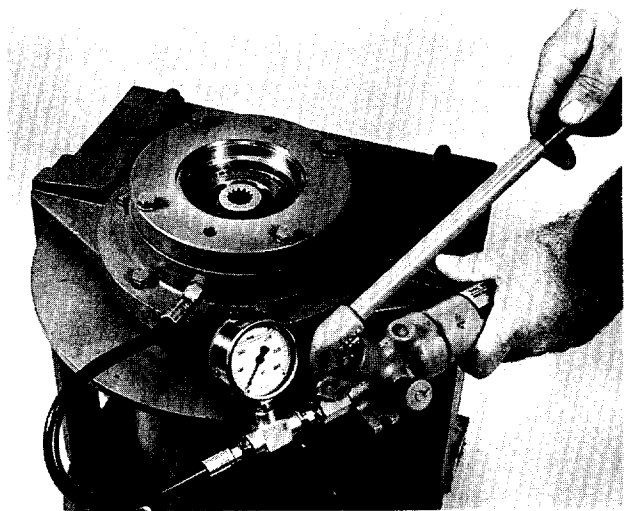
15. Install the brake clutch assembly.

When installed correctly, the cam should turn freely in the opposite direction the drum turns to pull wire rope in. An easy way to check the rotation is to hold the outer race in one hand, and rotate the cam.



⚠ WARNING

Be certain the snap ring is seated in the groove in the splined bore of the cam. This snap ring will keep the brake clutch assembly correctly positioned in the center of the friction brake pack. Binding of the brake or brake failure may occur if this snap ring is omitted.



16. If the brake discs are misaligned, preventing the installation of the clutch, then with a hand pump, apply 750-1,000 psi (5,170-6,900 kPa) to the brake release port. The brake discs will move freely with the brake released, permitting alignment of the discs, brake clutch and input sun gear.

MANUFACTURER BALLRING DATA

LUBRICATION

Periodic lubrication is necessary to insure long life and proper performance. The required frequency of lubrication varies with the type of equipment and amount of usage. Some recommendations for lubricants are given below.

Typical recommendations for greasing intervals vary according to operating conditions. Generally the following lubrication intervals are recommended:

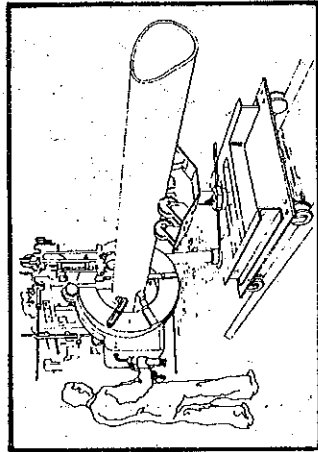
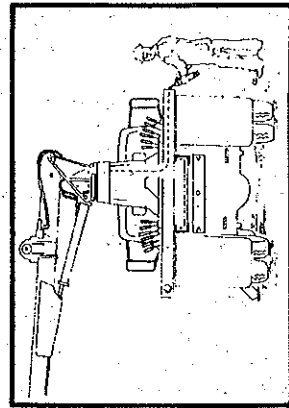
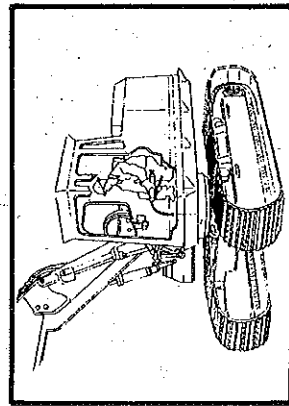
Ball bearings under light service	Every 100 operating hours
Ball bearings under heavy service or for a production type of application (e.g., excavators, grab cranes, magnet cranes, etc.) or where a high degree of reliability is required.	Every 40 operating hours
Roller bearings	Every 40 operating hours

Use shorter intervals between greasings in tropical areas or where there is high humidity, dust, or wide ranges in temperature, or when there is continuous rotation.

Each Rotek bearing is equipped with one or more grease fittings. Models equipped with two or three rows of fittings should be greased in each row. To insure uniform distribution of grease throughout the bearing, the machine should be rotated at least two complete revolutions while greasing. When complete rotation is impractical, more grease fittings are required. Contact the Rotek engineering department for a recommendation. For bearings with integral gears, lubricate gear as recommended above and as necessary to prevent metal-to-metal contact.

CAUTION:

Extreme care must be taken when greasing and rotating any unit. Be sure that all personnel are clear of all parts of the machine during the rotating-greasing procedure. We recommend installation of an extension line from the grease fitting location to an area where the oiler will be safely clear of moving parts. Following are three examples of suggested extension arrangement.



Extension fittings and lines are widely available from local distributors of lubrication equipment such as Alemite.

ALL EQUIPMENT SHOULD BE GREASED AT LEAST TWICE YEARLY REGARDLESS OF AMOUNT OF USAGE.

The bearing should be lubricated immediately after installation. Before storing a machine, new or used, thoroughly lubricate so that clean grease can be seen venting at the seals. This procedure should be repeated periodically at least twice a year or in line with climatic conditions. Uninstalled bearings stored inside, outside or in humid environments must be properly wrapped according to Rotek specifications. They must also be stored in the horizontal position. The bearing must also be uniformly supported to prevent ring distortion. Relubrication and inspection are required at periodic intervals. Contact Rotek for instructions.

Some recommended lubricants are shown below:

RACE	SHELL	EXXON	TEXACO	MOBIL	UNION	SUN
	ALVANIA EP #2	RONEX MP	MULTIFAK EP #2	MOBILITH AW2	UNOBA EP #2	PRESTIGE 742 EP
GEAR		SURRETT Fluid 30	CRATER 2x Fluid 5x Fluid	GEAR Lube 275	GEARITE Hvy	

Under extremely dusty or dirty conditions, sufficient grease should be added to flush out contaminated grease. Under less severe conditions, add grease until it appears at the seal. The metal nameplate illustrated below, which is affixed to many styles of bearings, provides lubrication instructions suitable to most applications. Extra plates are available on request for installation on equipment.

LUBRICATION INSTRUCTIONS—Lubricate bearing through fittings every one hundred operating hours (or per machine manufacturer's recommendation). Grease until grease is seen venting at the seal. Excess grease should be wiped off. Grease fittings should be cleaned before use. Below 22 F use No. 1 Grease. Rotate while greasing until clean grease extrudes at seal. Lubricate gear with Texaco Surratt Fluid 30. Check mounting bolt tightness periodically per machine manufacturer's recommendation.

SERIAL NO.

Rotek

**MANUFACTURER LOAD INDICATOR SYSTEM
MANUAL**

Part Number TW538

Revision A

MD Totco™

A Varco Company

INSTALLATION, CALIBRATION, AND OPERATION

Crane Load Indicator System

MODELS

SC6B, SC6C, SC6D, SC10, SC10A, SC10B

Manufacturers of Precision Instruments

Manual TW538 contains 22 pages, divided as follows:

Cover	March 1996
i through iii	March 1996
TOC-5 through TOC-6	March 1996
1-1	March 1996
2-1 through 2-3	March 1996
3-1 through 3-4	March 1996
4-1 through 4-5	March 1996
5-1	March 1996
6-1	March 1996
7-1	March 1996

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IMPORTANT SAFETY NOTICE

Proper service and repair is important to the safe, reliable operation of all **M/D TOTCO** equipment. The service procedures recommended by **M/D TOTCO** and described in the technical manuals are recommended methods of performing service operations. When these service operations require the use of tools specially designed for the purpose, those special tools should be used as recommended. Warnings against the use of specific service methods that can damage equipment or render it unsafe are stated in the manuals. These warnings are not exclusive, as **M/D TOTCO** could not possibly know, evaluate and advise service people of all conceivable ways in which service might be done or of all possible associated hazardous consequences. Accordingly, anyone who uses service procedures or tools which are not recommended by **M/D TOTCO** must first satisfy themselves thoroughly that neither personnel safety nor equipment safety will be jeopardized by the method selected.

LIMITED PRODUCT WARRANTY

THE FOLLOWING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS, IMPLIED OR STATUTORY, INCLUDING, BUT NOT BY WAY OF LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

M/D TOTCO warrants to Buyer ("Purchaser") of new products manufactured or supplied by **M/D TOTCO** that such products are, at the time of delivery to the Purchaser, free of material and workmanship defects, subject to the following exceptions: (a) Any product that has been repaired or altered in such a way, in **M/D TOTCO's** judgment, as to affect the product adversely, including any repairs, rebuilding, welding or heat treating outside of an **M/D TOTCO**-authorized facility, (b) Any product that has, in **M/D TOTCO's** judgment, been subject to negligence, accident or improper storage, (c) Any product that has not been installed, operated and maintained in accordance with normal practices and within the recommendations of **M/D TOTCO**, (d) For all items of special order by Purchaser that are not manufactured by **M/D TOTCO**, Purchaser should submit warranty claims directly to the manufacturer thereof.

M/D TOTCO's obligation under this warranty is limited to repairing or, at its option, replacing any products which, in its judgement, proved not to be as warranted within the applicable warranty period. All costs of transportation of products claimed not to be as warranted and of repaired or replacement products to or from authorized **M/D TOTCO** service facility shall be borne by Purchaser. **M/D TOTCO** may, at its sole option, elect to refund the purchase price of the products, and **M/D TOTCO** shall have no further obligation under the Sales Agreement.

The cost of labor for installing a repaired or replacement part shall be borne by Purchaser. Replacement parts provided under the terms of this warranty are warranted for the remainder of the warranty period of the product upon which installed to the same extent as if such parts were original components thereof.

The warranty periods for various products are: a) Hydraulics and Mechanical Equipment: one (1) year from date of installation or fifteen (15) months from date of shipment from **M/D TOTCO**, whichever occurs first, b) All Elastomer Diaphragms: six (6) months from date of shipment from **M/D TOTCO**, c) Electronic Equipment: six (6) months from date of shipment from **M/D TOTCO**.

TABLE OF CONTENTS

Paragraph/Title	Page
CHAPTER 1	
GENERAL INFORMATION	
1.0 GENERAL INFORMATION	1-1
1.1 General	1-1
1.4 Personnel Qualifications	1-1
1.5 Unpacking and Inspection	1-1
1.7 Precautionary Information	1-1
1.8 Related Publications	1-1
CHAPTER 2	
DESCRIPTION	
2.0 DESCRIPTION	2-1
2.1 General Description	2-1
2.2 Parameters	2-1
2.3 System Components	2-1
2.4 Hydraulic Cylinder	2-1
2.5 Indicator	2-1
2.6 MUDWATCH Specifications	2-1
2.7 J10900A Disconnects	2-1
2.8 Attaching and Support Hardware	2-1
2.9 Theory of Operation	2-2
CHAPTER 3	
INSTALLATION	
3.0 INSTALLATION	3-1
3.1 Pre-Installation	3-1
3.2 System Installation	3-1
CHAPTER 4	
CALIBRATION/OPERATION	
4.0 CALIBRATION/OPERATION	4-1
4.1 Factors Affecting Calibration/Operation	4-1
4.2 System Weight Test	4-1
4.3 System Operation	4-2
CHAPTER 5	
MAINTENANCE	
5.0 MAINTENANCE	5-1
5.1 General	5-1
5.2 Periodic Maintenance	5-1
5.3 Indicator Maintenance	5-1
CHAPTER 6	
TROUBLESHOOTING	
6.0 TROUBLESHOOTING	6-1
6.1 General	6-1

CHAPTER 7 REPAIR

7.0	REPAIR	7-1
7.1	Repair Procedures	7-1
7.2	Recharging the Load System	7-1
7.3	Bleeding the Load System	7-1

ILLUSTRATIONS

Figure 2-1	Typical Crane Weight Indicator Systems	2-2
Figure 2-2	J10900A Disconnect Assembly	2-3
Figure 3-1	Counting Parts Line	3-2
Figure 3-2	Typical Load Cell Installation Configurations	3-2
Figure 3-3	Overall Dimensions for 6-inch Indicator and Bracket	3-4
Figure 3-4	Overall Dimensions for 8 1/2-inch Indicator and Bracket	3-4
Figure 4-1	System Weight Test Worksheet (Sample)	4-3
Figure 4-2	Hydraulic Cylinder Charge/Recharge Dimensions	4-4
Figure 7-1	YA2 Hand Pump	7-1

TABLES

Table 6-1	Malfunction Isolation Chart	6-1
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TW538
CRANE LOAD INDICATOR SYSTEM - CYLINDER TYPE
MODELS SC6B - SC6C - SC6D - SC10 - SC10A - SC10B

JANUARY 1988

SECTION 1.0

GENERAL INFORMATION

1.1 GENERAL. This manual provides instructions for the installation, operation and maintenance for Martin-Decker's Crane Load Indicator Systems: SC6B, SC6C, SC6D, SC10, SC10A and SC10B Cylinder Type models.

NOTES:

1. Models SC6C and SC10A replaced Models SC6 and SC10 in production in December 1980.
2. Models SC6D and SC10B replaced Models SC6A and SC10A in production in June, 1988.

1.2 Read the appropriate section of this manual before attempting to perform any installation, operation or maintenance procedures described herein.

1.3 Ensure that all personnel who will be performing any of the procedures described in this manual, have read the **Important Safety Notice** on Page i.

1.4 PERSONNEL QUALIFICATIONS. Ensure that personnel who will install and operate the equipment are qualified by training or experience to work with the equipment.

1.5 UNPACKING AND INSPECTION. The SC Series Crane Load Indicator Systems are shipped in containers designed to protect them from the normal hazards encountered in transit. Carefully open the containers and inspect for damage or missing parts. Check the contents against the packing list. If any external damage or missing parts are apparent, immediately notify Martin-Decker and the shipping agency.

1.6 Martin-Decker reserves the right to change specifications at any time without prior notice.

1.7 PRECAUTIONARY INFORMATION. Two types of precautionary notices, WARNING and CAUTION, are found where

applicable, in Martin-Decker technical manuals. Locations of these precautionary notices are listed at the top of Page i.

The application of each type is as follows:

WARNING: Used where a possibility of damage to equipment or serious injury or death to personnel exists.

CAUTION: Used where a possibility of interruption of service exists.

1.8 RELATED PUBLICATIONS.

PUBLICATION NO.	SUBJECT:
TW517	SC28 & SC38 Series Crane Load Indicator Systems, Sensor Type
TW519	SB Series Crane Load and Radius Indicator System, Sensor Type
TW523	SR Series Crane Radius Indicator Systems
TW597	CLM2 Crane Load Moment Indicator System
TW610	CLM3 Crane Load Moment Indicator System
TW660	Crane Load Indicator (Compression Load Cell)
TW593	P325E Hydraulic Cylinder
TW673	P10012A Hydraulic Cylinder
TW1021	P10130A Hydraulic Cylinder

NOTE: The P10012A and P10017A replaced the P325E and P265D cylinders respectively in production in November 1980. P10130A replaced the P10012A in June, 1988.

TW538
CRANE LOAD INDICATOR SYSTEM - CYLINDER TYPE
MODELS SC6B - SC6C - SC6D - SC10 - SC10A - SC10B

SECTION 2.0

DESCRIPTION

2.1 GENERAL DESCRIPTION. The Cylinder Type Series SC Crane Weight Indicator Systems (Fig. 2-1), when installed and operated in accordance with the instructions contained in this manual, are designed to prevent crane overloading. The systems provide constant monitoring of load parameters of the crane on which they are installed. The systems are 100% hydraulically operated and require no external power source.

2.2 PARAMETERS. These Systems are designed to operate within an ambient temperature range of -20° and $+120^{\circ}$ F (-29° and $+49^{\circ}$ C). The system is accurate to plus or minus one percent of its rated full scale capacity when shipped from the factory.

2.3 SYSTEM COMPONENTS. The SC series systems are designed to individual crane requirements. The basic system consists of one hydraulic cylinder, (usually installed in the crane main fall rigging), and an indicator. A 6-inch indicator (GA104) is supplied with SC6B, SC6C and SC6D series systems. An 8-1/2-inch indicator (GD31) is supplied with SC10, SC10A and SC10B series systems. Listed below are the basic components of each system and attaching hardware:

- a. Hydraulic Cylinder
- b. Indicator
- c. Hydraulic Hose
- d. Disconnect Couplings
- e. Recharging Equipment
- f. Attaching and Supporting Hardware
- g. Tubing (optional)

2.4 HYDRAULIC CYLINDER. The hydraulic cylinder transmits a linear load signal to the indicator by transforming the applied load into a hydraulic pressure signal.

2.5 INDICATOR. The indicator has a scale calibrated in pounds, tons or kilograms as required by the user. It has a damper to smooth pointer sensitivity and adjust response to operator preference. Included on each indicator is a dial adjust gear to make

necessary tare adjustments. The indicator is filled with Martin-Decker W8 Gauge Fluid before operation for lubrication and protection against corrosion.

2.6 HYDRAULIC HOSE. The hydraulic hose (J234) connects the indicator gauge to the cylinder. The 1/4-inch high pressure hose is double wire braided and rubber covered. It is supplied in lengths to satisfy individual system requirements. Hose lengths greater than 50 feet are coupled with J10900A series disconnects.

2.7 J10900A DISCONNECTS. The system is normally supplied with a J10900A-02 female half disconnect (Fig. 2-2) installed on one end of the hose, and a J10900A-20 male half disconnect (Fig. 2-2) installed at the indicator damping chamber. When mated, these components constitute a J10900A Disconnect Assembly. Additional disconnects for connecting lengths of hose are supplied upon request.

2.8 ATTACHING AND SUPPORT HARDWARE. The system is furnished with all necessary attaching hardware to facilitate installation and maintenance.

- a. Check Valve. Normally installed on the damper and used to replenish or to reduce hydraulic fluid in the system. May be located elsewhere if desired.
- b. Indicator Bracket. For mounting the indicator inside the crane cab.
- c. Hydraulic Fluid. Supplied in quart (W15) or gallon (W16) containers and is used with the YA2 hand pump to charge the system in the field.
- d. YA2 Hand Pump. For field loading the system with hydraulic fluid. The pump swivel nut connects to the check valve on the indicator.
- e. C71 Tie Straps. For fastening the hose or tubing to the boom. One strap for every 10 feet of hose or tubing is normally supplied with each system.

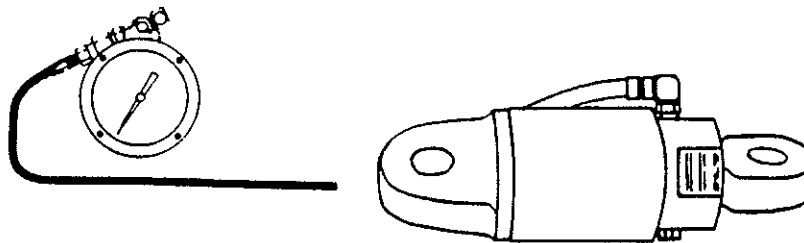
**CRANE LOAD INDICATOR SYSTEM - CYLINDER TYPE
MODELS SC6B - SC6C - SC6D - SC10 - SC10A - SC10B**

- f. Tubing (Optional). Copper tubing is normally used to supplement the hydraulic hose for fixed boom applications where boom lengths exceed 100 feet. Its PVC covering protects the tubing from chafing.

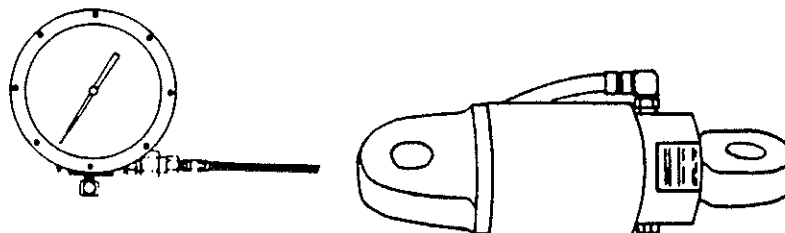
2.9 THEORY OF OPERATION.

- a. Load Indicator System. When a load is applied to the cylinder, a linear hydraulic pressure signal is generated by a diaphragm sensing element. This signal is transmitted through a high pressure hose to a bourdon tube type gauge assembly which indicates the amount of force on a weight dial (available in pounds, kilograms or decaNewtons).
- b. Load System Accuracy. The load indicating system is factory calibrated to within $\pm 1\%$ of full scale capacity. When the system is installed on a crane, several influencing factors, sheave friction in particular,

- may cause the indicated load to be outside the original calibration accuracy. A crane-installed system accuracy of $\pm 2.0\%$ of capacity, however, may be considered acceptable.
- c. Determining Hook Load. Factors affecting the accuracy of a dead end hydraulic cylinder application includes the number of lines reeved between the boom point sheaves and the block hook, the boom length and the boom angle. While hoisting, the friction of the sheaves causes the crane load indicator to indicate a load which is lighter than it actually is. This friction can be from 0.5% to 2% for each sheave in wire rope service. Conversely, sheave friction also causes the indicator to read high during lowering operations. To get an accurate indication of load weight, take the average of the indication obtained during hoisting and lowering operations. Refer to Section 4.0 for details in calculating 'Hoisting' and 'Lowering' readings, 'Mean Load Indicator Readings' and % Error.



MODEL SC6D



MODEL SC10B

Figure 2-1. Typical Crane Weight Indicator Systems.

TW538
CRANE LOAD INDICATOR SYSTEM - CYLINDER TYPE
MODELS SC6B - SC6C - SC6D - SC10 - SC10A - SC10B

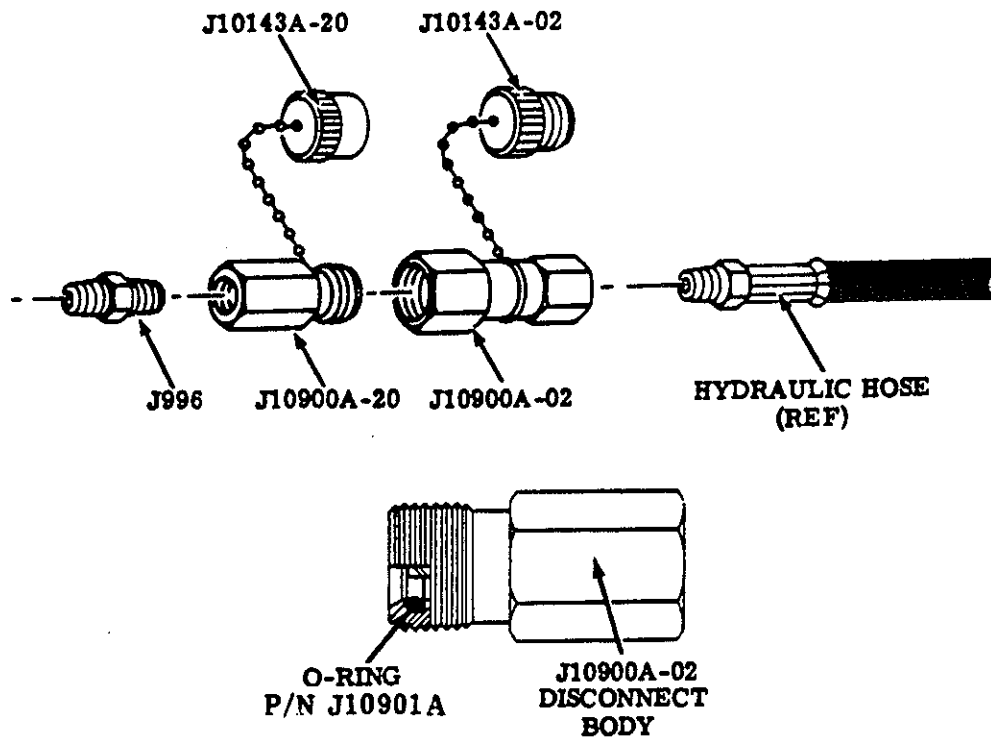


Figure 2-2. J10900A Disconnect Assembly.

TW538
CRANE LOAD INDICATOR SYSTEM - CYLINDER TYPE
MODELS SC6B - SC6C - SC6D - SC10 - SC10A - SC10B

SECTION 3.0

INSTALLATION

3.1 PRE-INSTALLATION CHECKS. Pre-installation procedure consists of verifying that the load indicating system is correct for the crane on which it is to be installed. Items to check:

- a. Ensure the indicator dial is calibrated in the units of measurement (pounds, tons, kilograms, etc.) compatible with the capacity of the crane as dictated by its configuration.
- b. Ensure the indicator dial is marked with parts of line to be used with crane configuration. If more than one reeving is to be used, there should be a separate scale on the dial (or a separate dial) for each of the reevings. See Fig. 3-1 for parts line determination.
- c. Cylinder capacity must be adequate for full crane capacity. To determine cylinder capacity, use either one of the following methods:
 1. For **even** parts line dead-ended at the boom, divide the system capacity by parts of line to determine cell load as follows:

$$\text{Cell Load} = \frac{\text{Crane Load}}{\text{Parts Line}}$$

2. For **odd** parts line with suspended upper load block and line dead-ended at the lower block (hook), multiply the capacity by the ratio of parts line. This ratio is 'parts line at upper block' divided by 'parts line at the hook' as follows:

$$\text{Cell Load} = \frac{(\text{Parts Line at Upper Block})}{(\text{Parts Line at Hook})} \times \text{Crane Load}$$

- d. Ensure hose or tubing is of adequate length for routing from

the indicator location to the cylinder, including extensions used when operating the crane with additional boom sections. Check the size and condition of all hose disconnects and collars to ensure they will not leak hydraulic fluid.

3.2 SYSTEM INSTALLATION.

CAUTION

The crane load system is hydraulically charged at Martin-Decker. Do not open the system except at disconnect couplings.

- a. Hydraulic Cylinder Installation. Select the method of installing the hydraulic cylinder, taking into account any obstructions and crane configuration. See Fig. 3-2 showing typical load cell installations.

CAUTION

To ensure proper cylinder operation, verify that the cylinder hangs free and completely clear of all obstructions at all operating angles of the boom. The cylinder must be free to align itself with the deadline or hanger to ensure that it does not bind.

- b. Hydraulic Hose and Tubing Installation.

CAUTION

During hydraulic hose and/or tubing layout and installation, (con't on page 3-3)

TW538
CRANE LOAD INDICATOR SYSTEM - CYLINDER TYPE
MODELS SC6B - SC6C - SC6D - SC10 - SC10A - SC10B

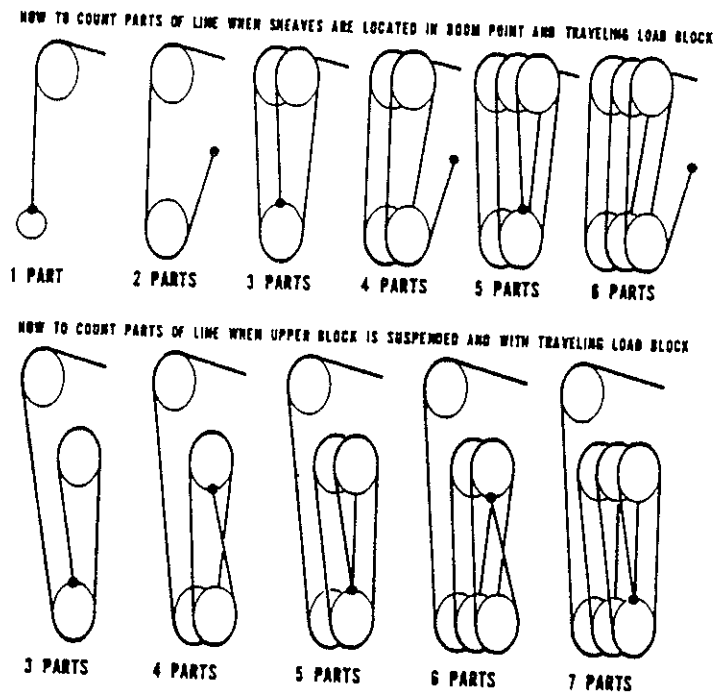


Figure 3-1. Counting Parts Line.

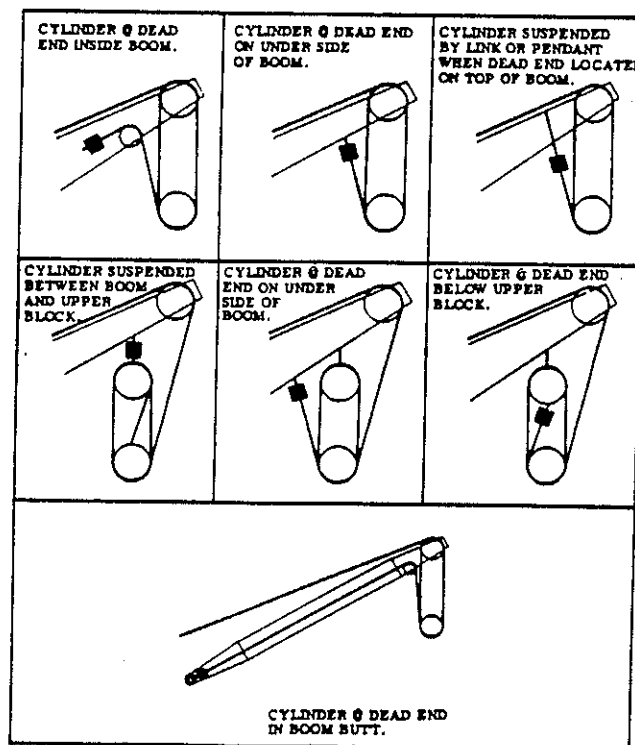


Figure 3-2. Typical Load Cell Installation Configurations.

TW538
CRANE LOAD INDICATOR SYSTEM - CYLINDER TYPE
MODELS SC6B - SC6C - SC6D - SC10 - SC10A - SC10B

allow sufficient slack in the hose to avoid pulling it taut during crane operation. Excess tension can cause connector failure.

CAUTION

Do not remove the plug from the damper assembly as hydraulic fluid may be lost.

Install hose and tubing as follows:

1. Route hose or tubing from hydraulic cylinder to indicator. Select the best layout to protect hoses and tubing from damage during crane operation. If tubing is being used, ensure that junction blocks are firmly secured to prevent tubing fittings from rotating and becoming loose.
 2. Connect the hose disconnects.
 3. Use C71 Tie Straps approximately every 10 feet to securely fasten hoses or tubing to the boom to prevent chafing, cutting, crushing or other damage during crane operation.
- c. Indicator Installation. Select a location for the indicator that provides a good visual access for the operator. Installation may be either inside or outside the crane cab.
1. Using Fig. 3-3 for the 6-inch indicator or Fig. 3-4 for the 8-1/2-inch indicator, locate and drill holes for the indicator mounting bracket.
 2. Install the bracket and indicator gauge.
- d. Post-Installation Checkout. After system installation is complete, check the following to ensure proper system operation:
1. Check all mounting hardware for secure installation.
 2. Lower boom. Check all fittings and connections for leaks; tighten if necessary to preserve the integrity of the Load Indicator System.
 3. Check that cylinder piston rod extension (gap) is within specifications shown in Fig. 4-2. If the gap is not within range, recharge the system. Refer to paragraph 7.3.
 4. Exercise the system through several cycles. Hoist a known weight of at least 25 percent of full crane capacity to approximately a foot off the ground, then lower it to remove weight from the rigging. Repeat several times to exercise the cylinder.
 5. On completion of step 4, remove weight from the hoist. Turn the tare adjust knob (knurled knob on back of the indicator) to rotate load dial to zero.

TW538
CRANE LOAD INDICATOR SYSTEM - CYLINDER TYPE
MODELS SC6B - SC6C - SC6D - SC10 - SC10A - SC10B

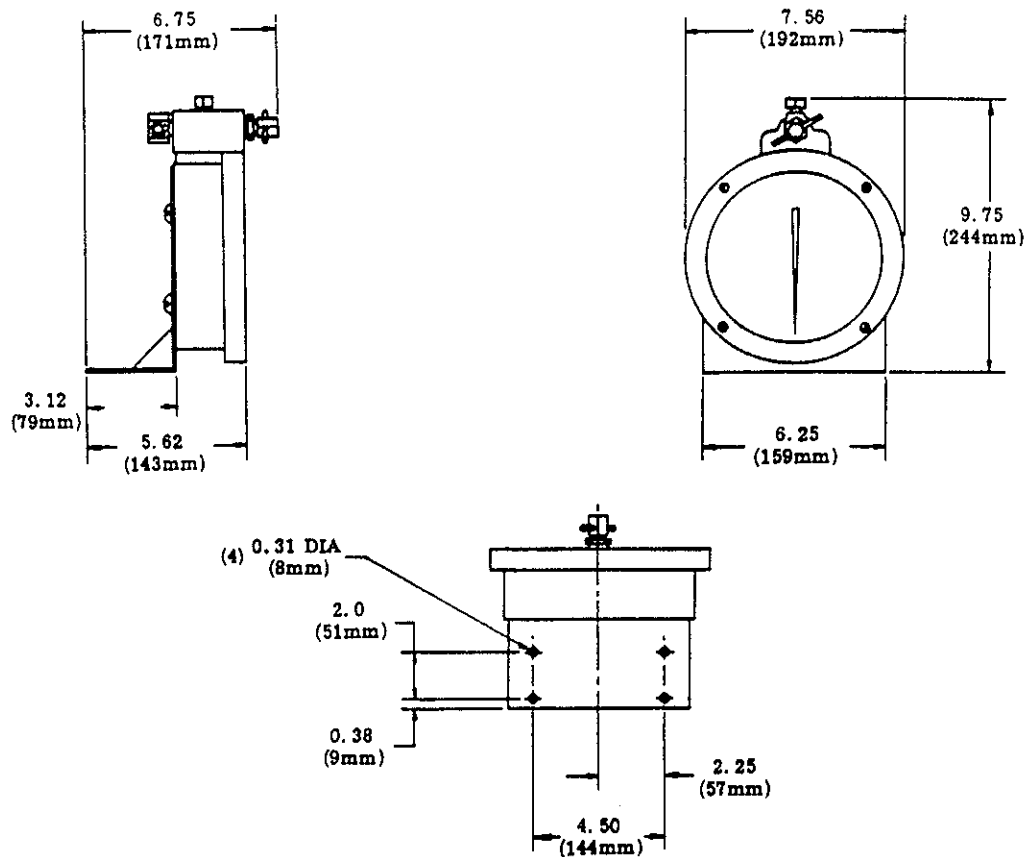


Figure 3-3. Overall Dimensions for 6-Inch Indicator and Bracket.

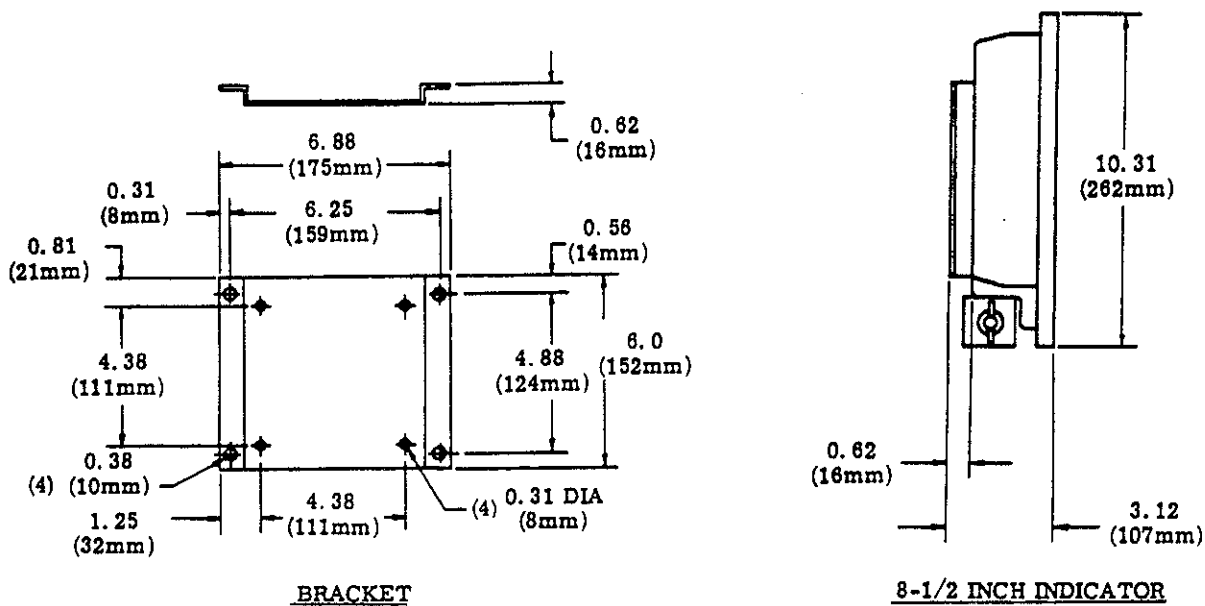


Figure 3-4. Overall Dimensions for 8-1/2-Inch Indicator and Bracket.

TW538
CRANE LOAD INDICATOR SYSTEM - CYLINDER TYPE
MODELS SC6B - SC6C - SC6D - SC10 - SC10A - SC10B

SECTION 4.0

CALIBRATION/OPERATION

4.1 FACTORS AFFECTING CALIBRATION/OPERATION. Factors affecting accuracy of a dead end load cell application include the number of lines reeved between the boom point sheaves and the hook block, the boom length and boom angle. While hoisting, the friction of the sheaves causes the crane weight indicator to indicate that load is lighter than it actually is. This friction can range from .5 to 2 percent for each sheave in wire rope service and also causes the indicator to read high during lowering operations. To get an accurate indication of load weight, take the average of the indication obtained during hoisting and lowering operations. For example:

- a. A crane is rigged with 4 parts line; load indication system capacity is 80,000 pounds.
- b. Load to be lifted is 65,000 pounds.
- c. Load cell is at dead end.
- d. Sheave friction equals $\frac{3}{4}$ of one percent per sheave.

When the load is raised, the load indicator reads 63,000 pounds; when the load is lowered, the load indicator reads 67,000 pounds. Mean or average value of the two readings is 65,000 pounds.

In addition, raising and lowering the boom will cause the indicator to show an increase, then a decrease in the indicated weight. This apparent discrepancy is caused by hydrostatic pressure and may be ignored once the weight of the load has been hoisted. The indication change due to the change in the hydrostatic head can be used as a quick test. Once during each operating day, cycle the boom from full stop to full stop and back again, noting the load indicator movement. It should rise and fall with the boom action. If the indication does not change, perform the weight test detailed below.

4.2 SYSTEM WEIGHT TEST. Use weight test worksheet (sample on page 4-3) to record and calculate data. The following equipment is needed to perform the test:

- a. Test weights used for calibration should be approximately 15, 35 and 75 percent of System capacity and must be accurate to within $\pm 1\%$. The weight of the rigging used for lifting test weights must also be known (to within $\pm 1\%$).
- b. Check that the cylinder gap (Fig. 4-2) is within specifications. If the gap is not within specifications, recharge or bleed the system as required. Refer to Section 7.0.
- c. Perform Zero set tare adjustment (paragraph 4.3).
- d. Record data as follows:

1. Enter the weight of the test weights in the table labeled 'Weight Test Specifications'.

NOTE: If lifting rigging is to be used, add the lifting rigging weight to the test weight. Enter total on the worksheet in the box indicated.

2. Determine "Mean Load" as follows:

- A. Hoist the 15% weight approximately 10 feet. In the table labeled "Mean Load Computations", record "Indicator Reading (Hoisting)" in the box indicated.
- B. Lower the weight two feet. Enter the "Indicator Reading (Lowering)" in the box indicated.
- C. Add the readings (Indicator Reading, Hoisting) and (Indicator Reading, Lowering) and enter the sum in the box indicated "Sum of Readings".
- D. Divide the "sum" (step C) by 2 and enter the result in the box labeled "Mean Indicator Reading".

TW538
CRANE LOAD INDICATOR SYSTEM - CYLINDER TYPE
MODELS SC6B - SC6C - SC6D - SC10 - SC10A - SC10B

- E. Repeat steps A, B, C and D for the 35% and 75% test weights.
 - F. Repeat steps A, B, C and D for the 35% test weight for the repeatability test.
3. On the worksheet, perform the "Percent of Error Computations" as follows:
- A. In the table noted "Percent of Error Computations", enter the "Actual Load" (Total Weight of Test Weight Plus Rigging), enter the "Mean Indicator Reading" and enter the "Total Indicator System Capacity". From these numbers, compute the % error as follows:

$$\% \text{ Error} = \frac{[(\text{Actual Load}) - (\text{Mean Indicator Reading})]}{\text{Indicator System Capacity}} \times 100$$

- B. If percent of error for all test loads is $\pm 1\frac{1}{2}\%$, the system is within the specifications. If percent of error is greater than $\pm 1\frac{1}{2}\%$, check and repair the hydraulic system. See Section 6.0 for Troubleshooting.
4. To determine repeatability,

enter the "2nd Hoist Mean Indicator Reading" and the "4th Hoist Mean Indicator Reading" in the table labeled "Repeatability Test".

- A. Calculate % error as follows:

% Error =

$$\left[\frac{(\text{2nd Hoist Mean Indicator Reading}) - (\text{4th Hoist Mean Indicator Reading})}{(\text{2nd Hoist Mean Indicator Reading})} \right] \times 100$$

- B. Calculated repeatability % Error should be less than or equal to 1%.

4.3 SYSTEM OPERATION.

- WARNING -

Before proceeding with the operation adjustments, make the following checks to avoid damage to the equipment or serious injury or death to personnel. Ensure that:

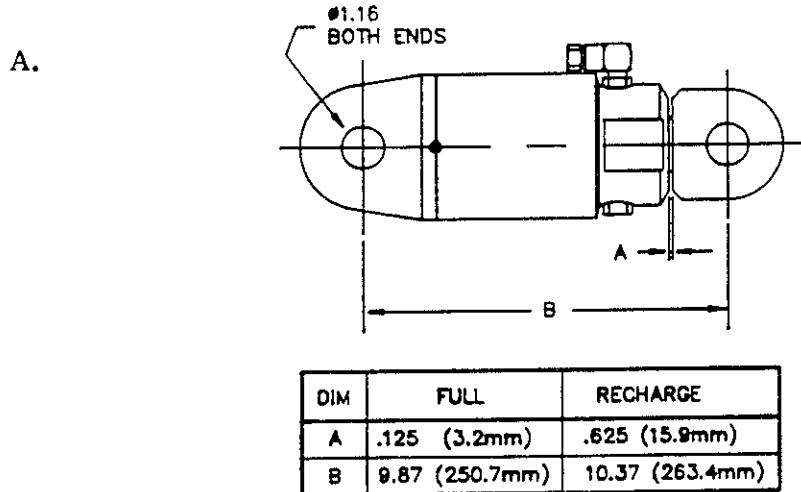
1. Parts line shown on the indicator dial match the crane rigging.
2. Capacities shown on the indicator dials match the load rating chart located in the crane cab.

TW538
CRANE LOAD INDICATOR SYSTEM - CYLINDER TYPE
MODELS SC6B - SC6C - SC6D - SC10 - SC10A - SC10B

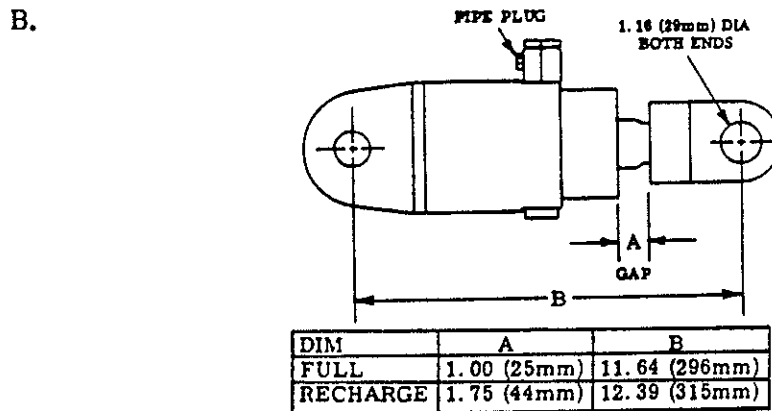
SYSTEM WEIGHT TEST WORK SHEET							
OWNER					DATE		
CRANE MFR:			MODEL:		SERIAL NO.		
DEVICE MFR: MARTIN-DECKER			MODEL		SERIAL NO.		
			SYSTEM CAPACITY:				
CRANE CONFIGURATION AT TIME OF TEST:							
LOCATION OF LOAD SENSOR:							
WEIGHT TEST SPECIFICATIONS							
	LOW WEIGHT (APPROX. 15%)		INTERMEDIATE WEIGHT (APPROX 35%)		HIGH WEIGHT (APPROX. 75%)		
TOTAL WEIGHT OF TEST WEIGHT PLUS RIGGING ($\pm 1\%$)							
MEAN LOAD COMPUTATIONS							
	1st HOIST 15%		2nd HOIST 35%		3rd HOIST 75%		4th HOIST 35%
INDICATOR READING (HOISTING \uparrow)							
INDICATOR READING (LOWERING \downarrow)							
SUM OF READINGS (HOISTING & LOWERING)							
MEAN INDICATOR READING MEAN INDICATOR READING = $\frac{\text{SUM}}{2}$							
PERCENT OF ERROR COMPUTATIONS							
HOIST	(ACTUAL LOAD	MINUS	MEAN INDICATOR READING	DIVIDED BY	INDICATOR SYSTEM CAPACITY	MULTIPLIED BY 100	% ERROR
1st HOIST		-		\div		$\times 100$	
2nd HOIST		-		\div		$\times 100$	
3rd HOIST		-		\div		$\times 100$	
REPEATABILITY TEST							
2nd HOIST 35% MEAN INDICATOR READING (HOISTING \uparrow)		MINUS	4th HOIST 35% MEAN INDICATOR READING (HOISTING \uparrow)	DIVIDED BY	2nd HOIST 35% MEAN INDICATOR READING (HOISTING \uparrow)	MULTIPLIED BY 100	% ERROR
		-		\div		$\times 100$	
4th HOIST SHOULD EQUAL SECOND HOIST WITHIN $\pm 1\%$							
CONDITION OF LOAD INDICATING DEVICE:							
INSPECTOR:			ORGANIZATION:			DATE:	

Figure 4-1. System Weight Test Worksheet (Sample).

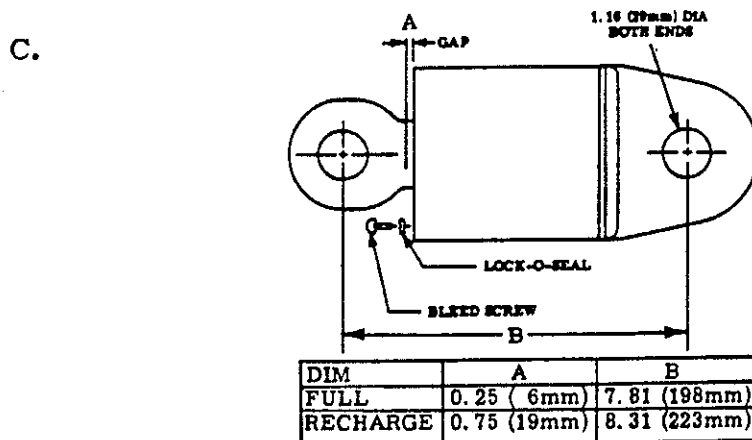
TW538
CRANE LOAD INDICATOR SYSTEM - CYLINDER TYPE
MODELS SC6B - SC6C - SC6D - SC10 - SC10A - SC10B



P10130A Hydraulic Cylinder (production effective 6/1/88)



P10012A-00003 Hydraulic Cylinder (production discontinued 6/1/88).



P325E-2 Hydraulic Cylinder (production discontinued 12/14/80)

Figure 4-2. Hydraulic Cylinder Charge/Recharge Dimensions.

TW538
CRANE LOAD INDICATOR SYSTEM - CYLINDER TYPE
MODELS SC6B - SC6C - SC6D - SC10 - SC10A - SC10B

- a. Indicator Test. At the beginning of each operating day, cycle the boom from full stop to full stop and back again, noting the indicator movement. It should rise and fall with the boom action. If the indication has not changed, perform the system weight test described in Paragraph 4.2.

- b. Load Pointer Zero Set (Tare Adjustment). Due to the effect of hydrostatic head (indicator variations because of changes in the height of the cylinder above the indicator), make a tare setting prior to hoisting each time the boom angle or load radius is changed:

1. Position the boom at the radius (boom at the angle) at which lift is to be made.
2. Remove any lifting rigging from the hook.
3. Turn the indicator dial zero adjustment knob (knurled knob on the back of the indicator case) and rotate the dial until the pointer is at zero.

NOTE: When reading the indicator, maintain a direct and perpendicular line of sight between the eye and the pointer in order to eliminate the possibility of parallax error.

- c. Tare Setting When Weighing. If the

crane load system is to be used for weight indication:

1. Position the boom at the radius where the lift is to be made.
2. Remove any lifting rigging from the hook.
3. Turn the indicator zero adjust knob until the pointer is at zero on the dial.
4. Hook up the lifting rigging and pick it off the ground. Note the weight of this rigging.
5. Turn the indicator zero adjust knob until the pointer is at zero on the dial.
6. The crane is now ready to weigh-lift.

- WARNING -

Weight of lifting rigging must be added to dial indication to ensure that the crane capacity is not exceeded.

- d. Pointer Damper Adjustments. The damper is located on top of the 6-inch indicator or on the bottom of the 8-1/2-inch indicator case and has a tee handle for adjustment.

1. If the pointer is too sensitive, push damper tee handle in and turn it clockwise to decrease pointer action.
2. If the pointer is sluggish, turn the tee handle counterclockwise to increase pointer sensitivity.

TW538
CRANE LOAD INDICATOR SYSTEM - CYLINDER TYPE
MODELS SC6B - SC6C - SC6D - SC10 - SC10A - SC10B

SECTION 5.0

MAINTENANCE

5.1 GENERAL. The systems described in this manual require little maintenance, however, general operating practices should include:

- a. Cleaning the indicator glass on an "as necessary" basis by using any good commercially available glass cleaning solution and a clean, soft, lint free cloth.
- b. Visual inspection of the system prior to use, with special attention paid to the integrity of fittings and connections, ensuring no leakage and that the load cell is free of any obstructions. Should any leakage or and other malfunction be observed, refer to Section 6.0.

5.2 PERIODIC MAINTENANCE. The Load Indicator System is designed for long, trouble free service involving little maintenance. Perform weekly inspections on the hoses to ensure they are not cut, crushed or otherwise damaged.

5.3 INDICATOR MAINTENANCE. If the movement should become sluggish or otherwise malfunction, inspection and repair should be performed only by qualified instrument personnel, otherwise, the instrument should be returned to Martin-Decker or an authorized repair facility. If replacement or repair of any parts is required, order them from Martin-Decker or any authorized representative. It is likely that re-calibration will be required if any repairs are performed on the indicator gauge. Ensure the indicator is repaired and calibrated only by qualified personnel.

TW538
CRANE LOAD INDICATOR SYSTEM - CYLINDER TYPE
MODELS SC6B - SC6C - SC6D - SC10 - SC10A - SC10B

SECTION 6.0

TROUBLESHOOTING

6.1 GENERAL. Most common system malfunctions can be remedied using Table 6-1 in conjunction with the repair procedures in the following paragraphs.

TABLE 6-1. MALFUNCTION ISOLATION CHART

MALFUNCTION	PROBABLE CAUSE	CORRECTIVE ACTION
No reading on indicator dial	No fluid in system	Recharge system (para 7.3)
	Obstruction in hose	Clear or replace hose
	Damper closed	Correct damper setting
Inaccurate load indication	Hydraulic system undercharged	Check hose connection for leakage; recharge system
	Worn indicator internal mechanism	Repair or replace indicator; contact Martin-Decker for service
	Improper zero (tare) setting	Adjust zero-set (tare); recharge system
Erratic or sluggish indicator reading	Improper damper setting	Correct damper setting
	Air in hydraulic system	Purge system of air by pumping W15 fluid through check valve on indicator and bleed through bleed plug on the cylinder
	Worn indicator internal mechanism	Repair or replace indicator; contact Martin-Decker for service
Continued loss of fluid at cylinder	Worn cylinder seals and/or piston	Contact Martin-Decker for service

TW538
CRANE LOAD INDICATOR SYSTEM - CYLINDER TYPE
MODELS SC6B - SC6C - SC6D - SC10 - SC10A - SC10B

SECTION 7.0

REPAIR

7.1 REPAIR PROCEDURES. The following procedures cover repairs that may be performed in the field and do not include detailed disassembly/assembly procedures for the indicator gauge, hydraulic cylinder or related equipment.

7.2 Field repairs consist of recharging or bleeding the hydraulic system and replacing faulty components, i.e., the indicator gauge, hydraulic cylinder or hoses.

7.3 RECHARGING THE LOAD SYSTEM.

- a. Assemble the hand pump and swivel as shown in Fig. 7-1.
- b. Remove the cap from the check valve on the damper.
- c. Attach the hand pump swivel nut to the check valve.

NOTE: Do not tighten the swivel nut at this time. It will be used to purge air from the system.

- d. Fill pump bowl with Martin-Decker W15/W16 (red) fluid.
- e. Stroke the pump until air is purged at the loose swivel nut, then tighten the nut.

NOTE: Keep pump reservoir at least one-half full at all times to prevent introducing air into the system.

- f. Raise the cylinder to a position slightly higher than the indicator gauge.
- g. Loosen truss head bleed screw at the base of P325E cylinder; or plug at the top of P10012A and P10130A cylinders.
- h. Pump fluid into the system and bleed at the cylinder screw (or plug) until air bubbles cease to appear.
- i. Tighten the cylinder bleed screw (or pipe plug).
- j. Pump enough fluid into the system

to slightly overcharge.

- k. Loosen cylinder screw (or plug) and bleed until correct gap is obtained.
- l. Tighten cylinder screw (or plug).
- m. Disengage the hand pump swivel nut from the check valve.
- n. Replace and tighten check valve cap.
- o. Adjust damper as necessary.

7.4 BLEEDING THE LOAD SYSTEM.

- a. Remove all weight from the cylinder.

NOTE: Use a rag or container to trap escaping fluid.

- b. Using a 5/8-inch wrench, loosen the check valve on the indicator until fluid begins to escape from the fitting.

CAUTION

Avoid backing the check valve all the way out or fluid may be lost from the system.

- c. While bleeding fluid, constantly check the cylinder gap (Fig. 4-2, dim. 'A') for proper reading.
- d. When cylinder gap is correct, retighten the check valve.
- e. Perform the Weight Test. See Section 4.0.

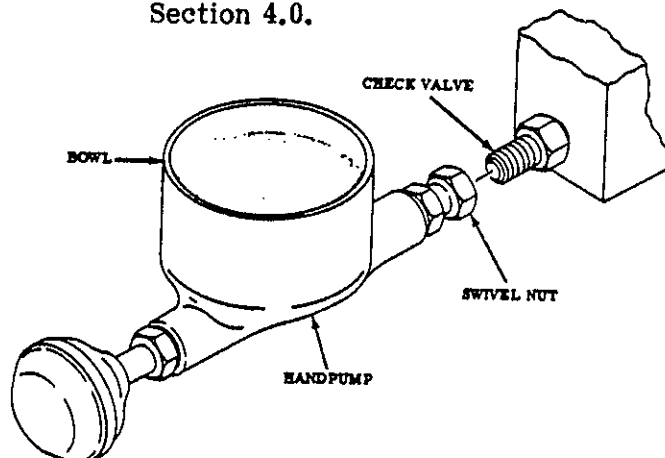


Figure 7-1. YA2 Hand Pump Assembly.

MANUFACTURER ELECTRIC SWIVEL MANUAL

APPLIED HYDRAULIC SYSTEMS

P.O. NO.: 64291
CAVOTEC JOB NO.: 100966-1

OPERATION, MAINTENANCE AND INSTRUCTION MANUAL

SLIPRING ASSEMBLY
MODEL NO. S-150T
CAVOTEC DRAWING NO. B-101627
25A - 4 Cond 600V
With 1" NPT Air Passage

CAVOTEC, INC.
124 HATFIELD RD.
STATESVILLE, NC 28625

TEL.: (800)-CAVOTEC FAX: (704)-873-3093

DOCUMENTATION

Slipring Unit S-150

Certificate Code: Eexd IIB T4

1 page: Warnings & Safety

4 page: NEMKO certificate

2 page: Maintenance manual S-150 with installation instruction

1 page: Drawing No. B-101567

WARNING

This manual is intended as a guide to the use and maintenance of this Cavotec product. Cavotec, Specimas S.p.A. or its affiliated Companies accept no liability for loss or damage suffered as a result of the use of this manual.

If in doubt, always refer to the original equipment manufacturer.

SAFETY

ELECTRICAL PRECAUTIONS

The slipring should be installed and grounded in accordance with local codes, ordinances, and the National Electrical Code.

Always disconnect and lockout electrical power to this unit before attempting to install, maintain or repair it.

Do not use this slipring with electrical loads greater than the rated current and voltage.

MAINTENANCE MANUAL S-150

1. GENERAL DESCRIPTION:

The Slipping Assembly is a NEMKO approved Eexd IIB unit. It means that the slipping assembly is designed to be used in a Zone 1 area where explosive gases can be present.

The following is a brief description of the Eexd IIB T4 code:

If an explosive gas is present in the same room as the slipping assembly, we can expect the same gas to be inside the enclosure of the slipping assembly. The gas inside the enclosure will be ignited by sparks occurring at the brush-to-ring interface. The explosion inside the enclosure will not ignite the gas on the outside of the enclosure because all gaps between flanges, bearings, shafts, etc. are of flameproof design.

The slipping assembly is tested by filling its enclosure with a pressurized flammable gas and igniting it. During ignition of the gas, the surrounding room is also filled with the same gas, which must not be ignited during the test. This is an absolute criteria for the NEMKO approval.

2. INSTALLATION OF SLIPRING ASSEMBLY

NOTE: Consult NEMKO test report and certification letter in addition to this manual.

The body of the slipping assembly is provided with an installation flange against the platform side.

The portion of the slipping unit which turns with the crane is connected to the crane via a torque arm.

The torque required to rotate the slipping unit is minimal since it depends upon the total friction of the brush-to-ring contacts and ball bearings.

IMPORTANT:

There must be some flexibility between the stationary and rotating part of the slipping unit, because some misalignment may occur during installation in the crane. If in doubt contact CAVOTEC as soon as possible.

If the unit is provided with cables and Eexd cable glands, these are not to be removed or replaced.

The slipping unit is equipped with an identification nameplate which describes the NEMKO classification. **THIS IDENTIFICATION PLATE IS NOT TO BE REMOVED OR COVERED.**

3. GENERAL DEMANDS CONCERNING MAINTENANCE:

The enclosure's ability to resist an internal explosion is tested and approved by NEMKO. NEMKO demands the utmost care during disassembly & reassembly. The flameproof joints cannot be allowed to become rusted, scratched, dented, cracked or deliberately modified in any form.

Unauthorized personnel cannot be allowed to perform maintenance on this unit. All replacement parts must be identical to the original ones and obtained from CAVOTEC, Inc.

4. **MAINTENANCE ROUTINES:**

a) **Daily inspection:**

This involves visually inspecting for surface corrosion, mechanical damage, the state of cable entries and checking surface temperature.

b) **Periodic inspection/-recommended each year:**

NOTE! Any disassembling and reassembling of the slipring unit chamber not performed by the manufacturer, excludes the manufacturer from any further liability. The frequency of this maintenance is dependent upon the intensity of use. Periodic inspection demands disassembly of the Exd. Enclosure.

The periodic inspection should cover:

- I. General condition inside the slipring unit.
- II. Brush wear.
- III. Slip ring wear.
- IV. Cable shoes and screws secured.
- V. Insulation surfaces (must be clean and dry)
- VI. The condition of the flameproof joints. These joints shall be treated with grease (not painted).
Scratches and/or dents in the flameproof joints are unacceptable.
- VII. Internal vacuum-cleaning.

5. **DISASSEMBLING:**

a) **Uncovering the main slipring unit in the Exd chamber:**

Disconnect all power.
Remove the (8) M10 screws and lift off the Exd enclosure.
Rings and brushes are now visible for inspection.

NOTE!

Use great care to prevent any marks, scratches and/or dents on the flange surfaces because these are part of the flameproof joints.
Wipe the enclosure flanges clean and regrease the flanges before reassembling.

6. **STORAGE**

- a) When not in use, the slipring unit should be kept in a clean, dry place, protected and preferably at room temperature. Slipring unit enclosures should be opened periodically to check for condensation. It is recommended that a self-contained or bagged absorbent material be placed in the slipring enclosure during extended periods of storage. Remove absorbent before placing the slipring into operation.

CAVOTEC NO.: 100966-1
DATE: 9-7-02
SHEET 1 OF 1

RECOMMENDED SPARE PARTS

CUSTOMER NAME: APPLIED HYDRAULIC SYSTEMS, INC.

ADDRESS: STATION 1, BOX 10155, HOUMA, LA 70363-5990

PURCHASE ORDER NUMBER: 64291

SPARE PARTS REQUIREMENT FOR: S-150T SLIP RING ASSEMBLY, DWG. B-101627

ITEM NO.	DESCRIPTION	QTY.	UNIT PRICE
1	P/N 150TS025/140 - 25 AMP. RING & BRUSH ASSY	4	\$173.04

NOTE: WHEN ORDERING SPARE PARTS PLEASE SPECIFY:

1. SERIAL NUMBER OF UNIT ON NAMEPLATE.
2. PART NUMBER AND DESCRIPTION OF PART.
3. MODEL OR TYPE NUMBER OF UNIT.

PRICES: FOB STATESVILLE, NC+ FREIGHT, FIRM FOR 30 DAYS UNLESS NOTED, TERMS NET 30 DAYS.

SECTION 5 CRANE REPAIR

SERVICE ASSISTANCE & ORDERING INFORMATION

24 Hours a Day

INTRODUCTION

This section contains information for ordering replacement parts for the equipment.



NOTE: CERTIFIED OEM REPLACEMENT PARTS CONTAIN NAUTILUS PART NUMBERS. INFORMATION ON PARTS NOT LISTED IN THIS MANUAL MUST BE RECEIVED FROM OSI NAUTILUS CRANE FOR PROPER VALIDATION AS NON-OEM PARTS MAY NOT MEET PERFORMANCE STANDARDS. ANY REPAIRS MADE WITH NON-OEM PARTS COULD EFFECT SAFE OPERATIONS OF THE CRANE AND CAUSE POSSIBLE PERSONNEL INJURY.

PARTS DELIVERY

To ensure prompt delivery of parts, be sure to give the correct name, address, town, state and country to which the parts are to be shipped. Include the Zip Code, if applicable, and specify the type of shipment. If the type of shipment is not specified, parts will be shipped by the best available means as determined by Oil States Industries.

PARTS AND SERVICE INQUIRIES

If difficulty is encountered with the repair of any assembly / component or if replacement parts are needed for any reason, contact the Oil States Industries Parts and Service Department for assistance at the following:

Oil States Industries
1180 Mulberry Road
Houma, LA 70363 USA

Telephone: (985) 868-0630
Toll Free: (800) 247-5530
Fax: (985) 851-0778

Oil States Industries Thailand Ltd.
450 Sukhumvit Road,
No. 102
Tambol Huaypong
Amphur Muang
Rayong 21150
Thailand

Telephone: + 66 (0) 38 691 643
Fax: + 66 (0) 38 691 644

BILL OF MATERIAL

REFERENCE DRAWINGS

M2002SK4-036 CRANE GENERAL ARRANGEMENT (FOR MANUAL USE ONLY)
M2002SK4-037 POWER UNIT GENERAL ARRANGEMENT (FOR MANUAL USE ONLY)
M2002SK1-087 HYDRAULIC SCHEMATIC (FOR MANUAL USE ONLY)
M2002SK1-089 ELECTRICAL SCHEMATIC (FOR MANUAL USE ONLY)
M2002SK1-090 ELECTRICAL DIAGRAM (FOR MANUAL USE ONLY)
M2002SK1-088 AIR SCHEMATIC (FOR MANUAL USE ONLY)

<u>HOSE LIST</u>					
ITEM	QTY	HOSE ID (IN)	PART NUMBER	LOCATION TO	LOCATION FROM
1	1	1"	N7B4216-300	Auxiliary Control Valve (Inlet)	Hydraulic Pump #1
2	1	1/4"	N7B4204-130	Auxiliary Pressure Gauge	Auxiliary Control Valve (Inlet)
3	1	1-1/4"	N76120-290	Return Manifold	Auxiliary Control Valve (Outlet)
4	1	1"	N7B4216-620	Auxiliary Hoist (Down)	Auxiliary Control Valve (down)
5	1	1"	N7B4216-240	Auxiliary Dump Valve (in)	Auxiliary Control Valve (Up)
6	1	1"	N7B4216-710	Auxiliary Hoist (Up)	Auxiliary Dump Valve (out)
7	1	1"	N7B4216-100	Main control valve (inlet tee)	Auxiliary control valve power beyond (check)
8	1	1 1/4"	N7A1120-340	Boom control valve (inlet)	Pump #2
9	1	1/4"	N7B4204-170	Boom pressure gauge	Boom control valve (inlet)
10	1	1 1/2"	N76124-290	Return manifold	Boom control valve (outlet)
11	1	3/4"	N76512-260	Boom cylinder up left	Boom control valve up
12	1	3/4"	N76512-210	Boom cylinder up right	Boom control valve up
13	1	3/4"	N76512-270	Boom cylinder down left	Boom control valve down
14	1	3/4"	N76512-220	Boom cylinder down right	Boom control valve down
15	2	1/4"	N7B4204-036	Counter balance valves	Boom cylinder down port

HOSE LIST

ITEM	QTY	HOSE ID (IN)	PART NUMBER	LOCATION TO	LOCATION FROM
16	1	1"	N7B4216-340	Main hoist control valve (inlet tee)	Pump #3
17	1	¼"	N7B4204-130	Main pressure gauge	Main control valve (inlet)
18	1	1 ½"	N76124-230	Return manifold	Main control valve (outlet)
19	1	1 ½"	N7A1124-620	Main hoist down	Main control valve down
20	1	1 ½"	N7A1124-210	Main dump (in)	Main control valve (up)
21	1	1 ½"	N7A1124-560	Main hoist (up)	Main dump valve (out)
22	1	¾"	N76412-300	Swing control valve (inlet)	Pump #4
23	1	¼"	N7B4204-120	Swing pressure gauge	Swing control valve (inlet)
24	1	1"	N76116-210	Return manifold	Swing control valve (outlet)
25	2	¾"	N76412-340	Swing drive	Swing control valve
26	1	¼"	N7B4204-340	Park brake	Swing control valve (1/4" check-inlet tee)
27	1	¼"	N7B4204-120	Park brake valve (in)	Swing control valve (1/4" check-inlet tee)
28	1	¼"	N7B4204-340	Hydraulic tank	Park brake valve (out)
29	1	¼"	N7B4204-350	Dynamic brake	Dynamic brake actuator
30	1	¼"	N7B4204-210	Swing brake cooler	Return manifold (1/4" flow control)
31	1	¼"	N7B4204-330	Hydraulic tank	Swing brake cooler (out)
32	1	½"	N7B4204-090	Aux dump valve (1/2" check tee)	Main dump valve (1/2" check tee)
33	1	½"	N7B4208-260	Anti-2 block override (in)	Aux dump valve (1/2" check-tee)
34	1	½"	N7B4208-280	S/S tubing base pressure	Anti-2 block override valve (out)
35	1	½"	N7B4208-190	Main CBSD valve (in)	S/S tubing tip pressure
36	1	½"	N7B4208-300	Aux CBSD valve (in)	S/S tubing tip pressure

HOSE LIST

ITEM	QTY	HOSE ID (IN)	PART NUMBER	LOCATION TO	LOCATION FROM
37	1	½"	N7B4208-192	S/S tubing tip return	Main CBSD valve (out)
38	1	½"	N7B4208-304	S/S tubing tip return	Aux CBSD valve (out)
39	1	½"	N7B4208-340	Hydraulic tank	S/S tubing base return
40	1	¼"	N7B4204-190	Main case drain (tee)	Aux case drain
41	1	¼"	N7B4204-340	Hydraulic tank	Main case drain (tee)
42	1	¼"	N7B4204-320	Return pressure gauge	Return manifold
43	1	3"	N7A7548-190	Return filter	Return manifold
44	1	¼"	N7B5104-075	Load cell gauge	Load cell
45	1	¼"	N7B4204-480	Engine oil pressure gauge	Engine block
46	1	1"	N76116-220	Air swivel (bottom)	Pedestal wall
47	1	1"	N76116-390	Air tank (in)	Air swivel (top check)
48	1	1"	N76116-160	Air relay valve (in)	Air tank (out)
49	1	1"	N76116-400	Air starter	Air relay valve (out)
50	1	¼"	N7B4204-140	Start valve (in-tee)	Air relay valve (in)
51	1	¼"	N7B4204-350	Air pressure gauge	Air start valve (in-tee)
52	1	¼"	N7B4204-350	Air relay valve "APP"	Air start valve (out)
53	1	¼"	N7B4204-420	Air wiper valve (in)	Air tank
54	1	¼"	N7B4204-500	Throttle cylinder	Throttle actuator
55	1	¼"	N7B4204-180	Pressure switch (electric)	Oil pressure gauge
56	1	2 ¼"	N7A5340-088	Pump #1	Hydraulic tank
57	1	2"	N7A5332-088	Pump #2	Hydraulic tank

HOSE LIST

ITEM	QTY	HOSE ID (IN)	PART NUMBER	LOCATION TO	LOCATION FROM
58	1	2"	N7A5332-088	Pump #3	Hydraulic tank
59	1	1 ½"	N7A5324-088	Pump #4	Hydraulic tank
60	1	3/8"	N7806-110	Fuel pump	Fuel tank
61	1	3/8"	N78106-140	Sentinel (in)	Fuel filter
62	1	3/8"	N78106-140	Fuel rack (in)	Sentinel (out)
63	1	5/16"	N78105-120	Fuel tank	Fuel rack (out)
64	1	¼"	N7B4204-130	Sentinel (in)	Engine oil pressure
65	1	¼"	N7B4204-120	Water temp probe (tee-in)	Sentinel (out)
66	1	¼"	N7B4204-140	Oil temp probe (tee)	Water temp probe (tee-in)
67	1	¼"	N7B4204-140	Water temp probe (vent-in)	Oil temp probe (vent)
68	1	¼"	N7B4204-120	Engine block	Water temp probe (vent-tee)
69	-	-	-	-	-
70	-	-	-	-	-
71	-	-	-	-	-
72	-	-	-	-	-

PARTS LIST

<u>ITEM</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
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BOOM AND RIGGING

73	1	N61612-060	Boom Weldment (Rev. J)
74	1	N61945-001	Boom Foot Pin
75	2	N47105-002	Boom Butt Insert Bushing
76	1	N61165-004	Boom Foot Pin Keeper Plate
77	1	N45916-001	Boom Angle Indicator Placard (Right Hand)
78	1	N60255-005	Boom Angle Indicator Needle
79	1	N61640-145	Boom Roller
80	1	N61640-146	Boom Roller
81	1	N61640-147	Boom Roller
82	930 ft.	N00163-010	Main Wire Rope
83	1	N46647-002	Main Wire Rope Anchor
84	1	N46432-004	Main Hoist
85	1	N46419-002	Main Hoist Bolt Kit (Not Shown)
86	1	N61984-016	Main Hoist Mounting Plate
87	1	N61308-001	Main/Auxiliary Idler Sheave Pin
88	1	N60014-012	Main/Auxiliary Idler Sheave Pin Keepers
89	1	N20208-092	Main/Auxiliary Idler Sheave Pin Keeper Bolt W/Lock Nut
90	1	N45931-010	Main Idler Sheave
91	2	N45422-013	Main Idler Sheave Bearing
92	2	N61991-004	Main Idler Sheave Bearing Retainer
93	1	N61308-002	Main Sheave Pin
94	2	N60014-012	Main Sheave Pin Keepers

PARTS LIST

<u>ITEM</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
<u>BOOM AND RIGGING (CONT'D)</u>			
95	1	N20208-092	Main Sheave Pin Keeper Bolt W/Lock Nut
96	2	N45931-010	Main Sheaves
97	2	N45422-013	Main Sheave Bearings
98	4	N61991-004	Main Sheave Bearing Retainer
99	2	N60646-004	Load Cell Pins
100	1	N60645-001	Main Extended Wedge Socket Pin
101	1	N30602-005	Main Open Wedge Socket
102	1	N30606-010	Main Wire Rope Clamp
103	4	N30601-006	Main Wire Rope Shackles
104	2	N45315-048	Main Anti-Two Block Suspension Cables
105	1	N45943	Main Anti-Two Block Valve
106	1	N46831-054	Main Load Block
107	1	N46831-054-1	Main Load Block Safety Latch
108	297 ft	N00163-008	Auxiliary Wire Rope
109	1	N46647-006	Auxiliary Wire Rope Anchor
110	1	N46285-008	Auxiliary Hoist
111	1	N46419-004	Auxiliary Hoist Bolt Kit (Not Shown)
112	1	N61535-047	Auxiliary Hoist Mounting Plate
113	1	N45931-010	Auxiliary Idler Sheave
114	1	N45422-013	Auxiliary Idler Sheave Bearing
115	1	N61991-004	Auxiliary Idler Sheave Bearing Retainer
116	1	N61010-006	Auxiliary Extension Sheave Pin
117	2	N60014-010	Auxiliary Extension Sheave Pin Keeper

PARTS LIST

<u>ITEM</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
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BOOM AND RIGGING (CONT'D)

118	1	N20208-080	Auxiliary Extension Sheave Pin Keeper Bolt W/Lock Nut
119	1	N45421-011	Auxiliary Extension Sheave
120	1	N45422-006	Auxiliary Extension Sheave Bearing
121	1	N61991-002	Auxiliary Extension Sheave Bearing Retainer
122	1	N30602-003	Auxiliary Open Wedge Socket
123	1	N30606-008	Auxiliary Wire Rope Clamp
124	4	N30601-006	Auxiliary Wire Rope Shackles
125	2	N45315-048	Auxiliary Anti-Two Block Suspension Cables
126	1	N45943	Auxiliary Anti-Two Block Valve
127	2	N60989-001	Anti-two Block Hangers
128	1	N46832-001	Auxiliary Overhaul Ball
129	1	N46832-001-1	Auxiliary Load Block Safety Latch
130	-	-	-
131	-	-	-
132	-	-	-
133	-	-	-
134	-	-	-
135	-	-	-
136	-	-	-
137	-	-	-
138	-	-	-
139	-	-	-

PARTS LIST

<u>ITEM</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
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TURRET

140	1	N2002SK1-085	Pedestal Weldment (Rev. A)
141	1	N45958-001	Ballring
142	1	N47255-010	Ballring To Pedestal Bolt Kit
143	1	N47255-009	Ballring To Turret Bolt Kit
144	1	N61933-002	Turret Weldment (Rev. F)
145	1	N61337-005	Turret Machining, Rev. B (Not Shown)
146	1	N61676-019	Walkway and Supports
147	1	N2002SK1-166	Access Ladder
148	2	N61297-002	Cylinder to Turret Pins W/Keepers
149	2	N60006-093	Cylinder To Boom Pins
150	2	N60014-040	Cylinder To Boom Pin Keepers
151	2	N20216-128	Cylinder To Boom Pin Keeper Bolts w/Lock Nuts
152	2	N47035-002	Luffing Cylinders
153	2	N47035-501	Luffing Cylinder Seal Kits (Not Shown)
154	4	N46700-006	Spherical Bearings
155	2	N12972-001	Counterbalance Valves
156	4	N12622-002	Hydraulic Swivels
157	1	N45686-005	Swing Motor
158	1	N47199-001	Swing Brake

***WARNING:** These are special bolts meeting SAE Grade 8 and API Specification 2C requirements and must be purchased from Applied Hydraulic Systems, Inc. Standard off the shelf Grade 8 bolts **MUST NOT BE USED** as they do not meet the requirements of API Spec 2c.

PARTS LIST

<u>ITEM</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
<u>TURRET (CONT'D)</u>			
159	1	N47103-002	Gearbox
160	1	N60265-002	Pinion Cap Plate
161	1	N45853-001	Pinion
162	1	N61196-003	Pinion Guard
163	1	N60613-089	Return Manifold
164	2	N80299-002	Dump Valve
165	2	N45674-011	Check Valve
166	1	N45419-004	Flow Control Valve
167	1	N80196-004	Emergency Load Lowering Kit (Not Shown)
168	1	N47021-041	Electric Swivel
169	1	N61242-017	Lube Manifold
170	1	N46649-002	Tool Box
171	-	-	-
<u>CAB</u>			
172	1	N80278-043	Cab Weldment (Rev. -)
173	1	N60950-034	Cab Tray
174	1	N46621-001	Cab Right Side Sliding Window
175	1	N80278-214	Cab Door Latch
176	1	N80278-213	Cab Door Handle
177	20 ft.	N80278-220	Cab Door Gasket
178	1	N2002SK1-183	Cab Step
179	3	N46051-002	Air Windshield Wiper Assembly

PARTS LIST

<u>ITEM</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
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CAB (CONT'D)

180	1	N45408-067	Swing Control Valve
181	1	N46675-020	Auxiliary Control Valve
182	1	N47010-001	Main Control Valve
183	1	N46675-005	Boom Control Valve
184	1	N80344-189	Control Valve Linkage Assembly W/Lever
185	3	N45130-004	Control Lever Knobs
186	1	N13755-003	Seat
187	1	N46353-002	Seat Swivel
188	1	N61059-004	Seat Pedestal
189	1	N45025-001	Parking Brake Valve
190	1	N45025-501	Parking Brake Valve Spring Kit
191	1	N45025-502	Parking Brake Handle Kit
192	1	N45674-009	Check Valve
193	1	N46018-360	Engine Kill Cable
194	1	N46018-360	Emergency Engine Kill Cable
195	1	N45386-001	Start Valve Push Button
196	1	N45384-001	Dynamic Foot Brake Actuator
197	1	N45674-005	Check Valve
198	1	N45813-001	Dynamic Foot Brake Actuator Reservoir
199	1	N45358-001	Foot Throttle Actuator w/Reservoir
200	1	N45376-001	Hand Signal Chart
201	1	N2002SK3-035	Lifting Load Capacity Chart

PARTS LIST

<u>ITEM</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
<u>CAB (CONT'D)</u>			
202	1	N61322-004	Gauge Panel
203	1	N46017-004	Tachometer
204	1	N46748-028	Water Temperature Gauge
205	1	N46748-028	Hydraulic Oil Temperature Gauge
206	1	N47318-050	Boom Pressure Gauge
207	1	N47318-050	Main Pressure Gauge
208	1	N47318-050	Auxiliary Pressure Gauge
209	1	N47318-050	Swing Pressure Gauge
210	1	N47318-001	Return Pressure Gauge
211	1	N47318-006	Air Pressure Gauge
212	1	N47318-002	Engine Oil Pressure Gauge
213	1	N45729-033	Load Indicator System
214	1	N45729-033-1	Load Gauge
215	1	N45729-033-2	Load Cell
216	1	N45729-033-3	Clevis
217	2	N45729-033-4	Hoses
218	2	N45729-033-5	Disconnect Couplings (Male)
219	2	N45729-033-6	Disconnect Couplings (Female)
220	1	N45729-033-7	Hand Pump (Not Shown)
221	1	N45729-033-8	Fluid (Not Shown)
222	1	N93SK1-083	Load Indicator Mounting Bracket
223	-	-	-
224	-	-	-

PARTS LIST

<u>ITEM</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
<u>CAB (CONT'D)</u>			
225	-	-	-
226	-	-	-
227	-	-	-
228	-	-	-
229	-	-	-
230	-	-	-
<u>POWER UNIT</u>			
231	1	N61833-003	Power Unit Weldment (Rev. -)
232	350 gal.	N13764-001	Hydraulic Oil Storage Capacity (Not Shown)
233	175 gal.	N00178-001	Fuel Storage Capacity (Not Shown)
234	1	N45012-002	Cleanout Cover
235	1	N45012-527	Gasket
236	1	N45690-030	Hydraulic Oil Level Gauge
237	1	N45125-001	Hydraulic Oil Fill/Vent
238	1	N45690-030	Fuel Level Gauge
239	1	N45125-001	Fuel Fill/Vent
240	2	N46178-012	Tank Drain Ball Valves
241	2	N45921-032	Suction Strainers
242	3	N45921-028	Suction Strainer
243	1	N60863-011	Return Filter Assembly
244	1	N47204-001	Return Filter
245	2	N47204-501	Return Filter Elements

PARTS LIST

<u>ITEM</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
<u>POWER UNIT (CONT'D)</u>			
246	1	N45923-003	Tachometer Magnetic Pickup
247	1	N46785-346	Hydraulic Pump
248	1	N45031-504	Engine Adaptor
249	1	N45031-513	Drive Plate
250	1	N45031-521	Pump Sleeve
251	1	N46587-002	Air Start Motor
252	1	N47233-001	Sentinel Fuel Shutoff System
253	1	N47232-003	Chalmatic Air Intake Shutdown Valve
254	1	N46101-015	Rain Cap
255	1	N47097-001	Relay Valve
256	1	N45357-005	Air Lubrication
257	1	N45272-004	Spark Arrestor Silencer
258	1	N46996-005	Engine
259	1	N46996-533	Radiator W/Cap
260	1	N46996-504	Radiator Shroud
261	1	N46996-503	Radiator Fan Guard
262	1	N46996-510	Primary Fuel Filter
263	1	N46996-511	Secondary Fuel Filter
264	1	N46996-512	Oil Filter
265	1	N46996-555	Air Cleaner Assembly
266	1	N46996-556	Engine Mounted Tachometer
267	1	N46996-551	Engine Fan Belt
268	1	N46996-549	Turbo Charger

PARTS LIST

<u>ITEM</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
<u>POWER UNIT (CONT'D)</u>			
269	1	N46996-518	Fan Pulley System
270	1	N46996-552	Belt Tensioner
271	1	N46996-520	Flywheel
272	1	N46996-535	Water Pump
273	1	N46996-522	Fan Blade
274	1	N46996-508	Fuel Pump
275	1	N46996-558	Fuel Priming Pump
276	1	N46996-523	Upper Radiator Hose
277	1	N46996-553	Lower Radiator Hose
278	1	N46996-540	Engine Hood & Back Panel
279	1	N46996-507	Engine Side Panels
280	1	N46996-557	Cable
281	1	N47164-002	Air Tank
282	1	N45445-002	Pop Off Valve
283	2	N46178-008	S.S. Ball Valve
284	1	N98SK1-256	Starter Bolt Spacer
285	-	-	-
<u>BRACKETS</u>			
287	1	N62214-004	Chalmatic Air Shutdown Bracket
289	1	N2002SK1-210	Chalmatic Air Adapter
290	1	N61738-016	Electric Swivel Bracket
291	1	N80402-005	Boom Tip Mounting Assembly

PARTS LIST

<u>ITEM</u>	<u>QTY.</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
<u>ELECTRICS</u>			
292	1	N46238-003	Red Beacon Light
293	1	N47514-001	Air Conditioner
294	1	N46868-010	Cab Light w/Bulb
295	1	N46534-002	4 Device Enclosure
296	1	N46540-002	Green Pilot Light
297	1	N46537-001	Cab Light Switch
298	1	N46537-001	Flood Light Switch
299	1	N46536-001	Push Button
300	1	N46405-006	Junction Box w/Back Plate
301	1	N45425-001	Pressure Switch
302	1	N45038-001	Circuit Breaker Box
303	1	N45039-001	Circuit Breaker Cover
304	1	N45037-001	Circuit Breaker 10 Amp
305	1	N45037-001	Circuit Breaker 20 Amp
306	1	N46878-501	Telephone Handset
307	1	N46878-504	TelephoneHeadset
308	1	N46878-507	Driver Speaker
309	1	N46878-505	Headset w/Extension Cable
310	1	N47137-003	Attention Horn
311	1	N46878-506	Horn / Speaker
312	175'	N45044-017	Electric Cable 12/3
313	-	-	-
314	-	-	-

CRANE GENERAL ARRANGEMENT DRAWING



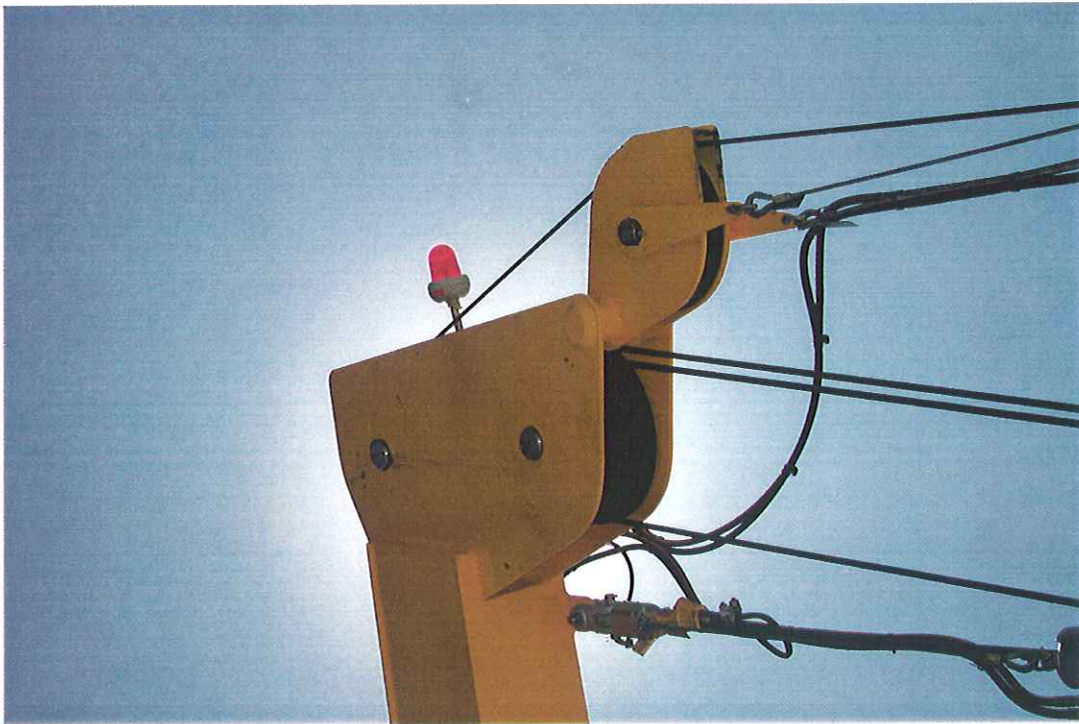
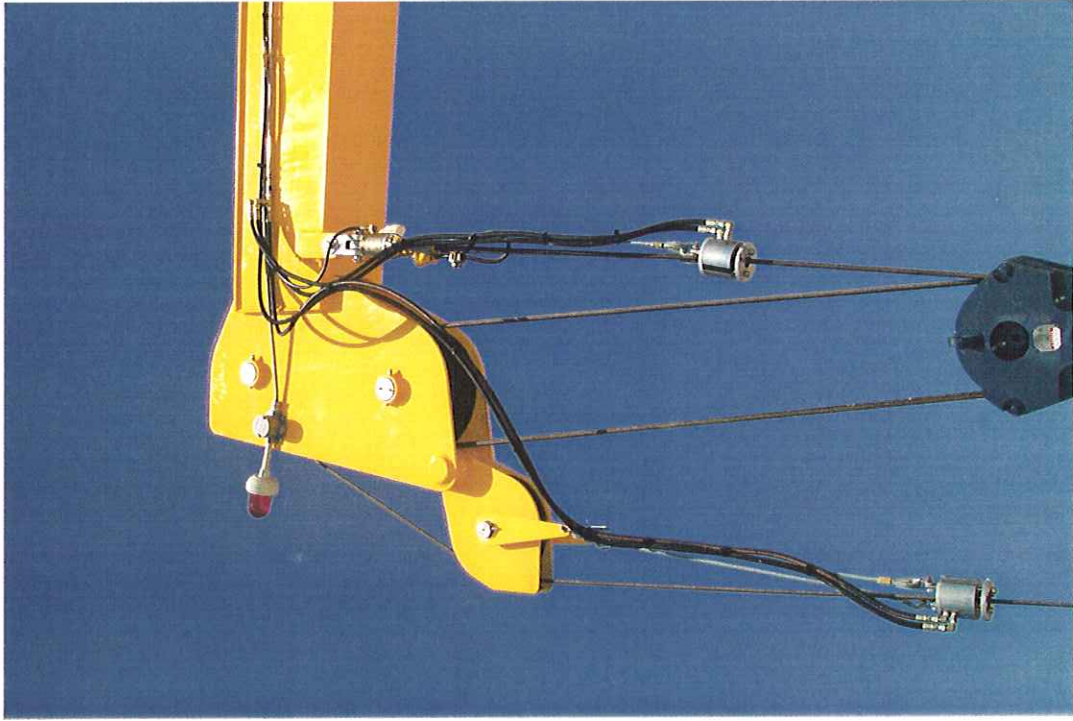
CRANE GENERAL ARRANGEMENT



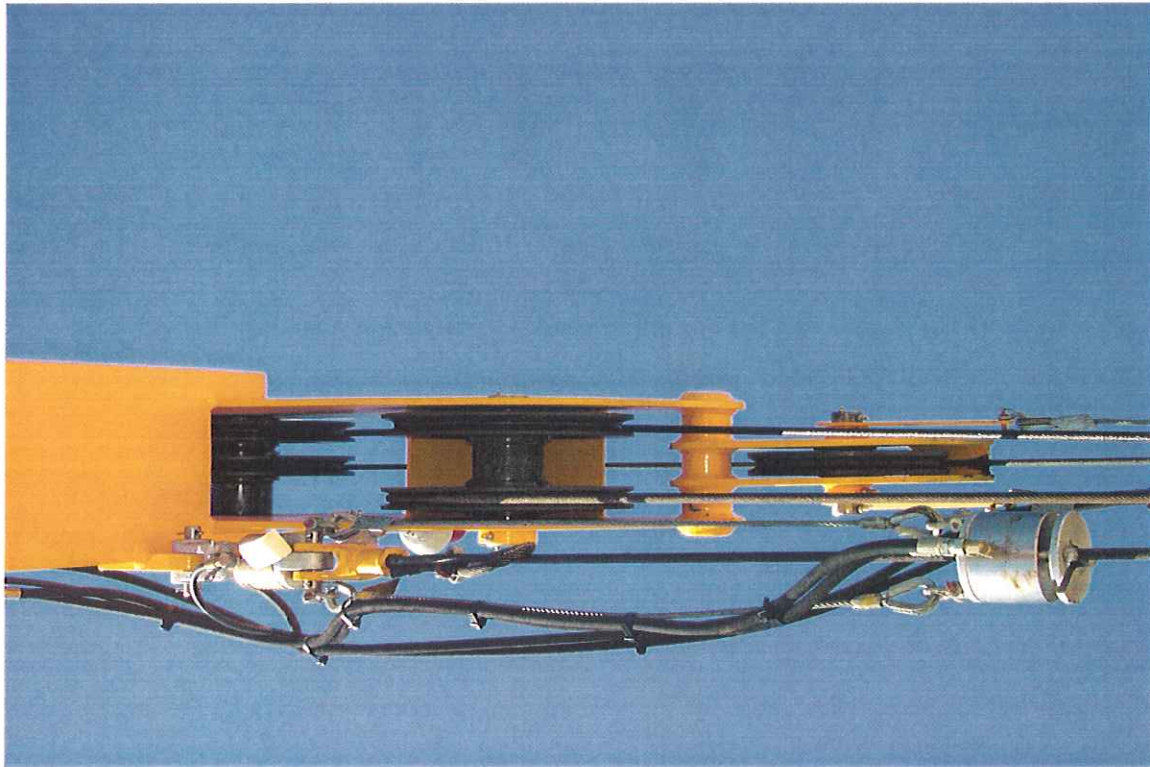
CRANE GENERAL ARRANGEMENT



CRANE GENERAL ARRANGEMENT



CRANE GENERAL ARRANGEMENT



CRANE GENERAL ARRANGEMENT



CRANE GENERAL ARRANGEMENT

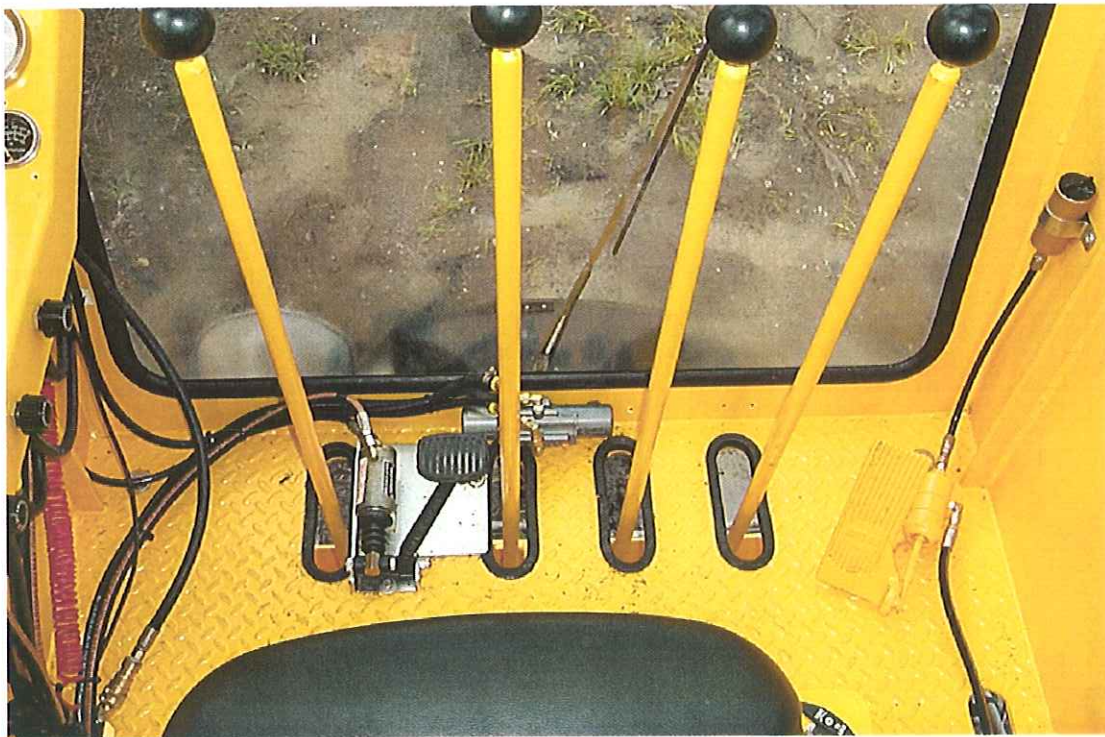
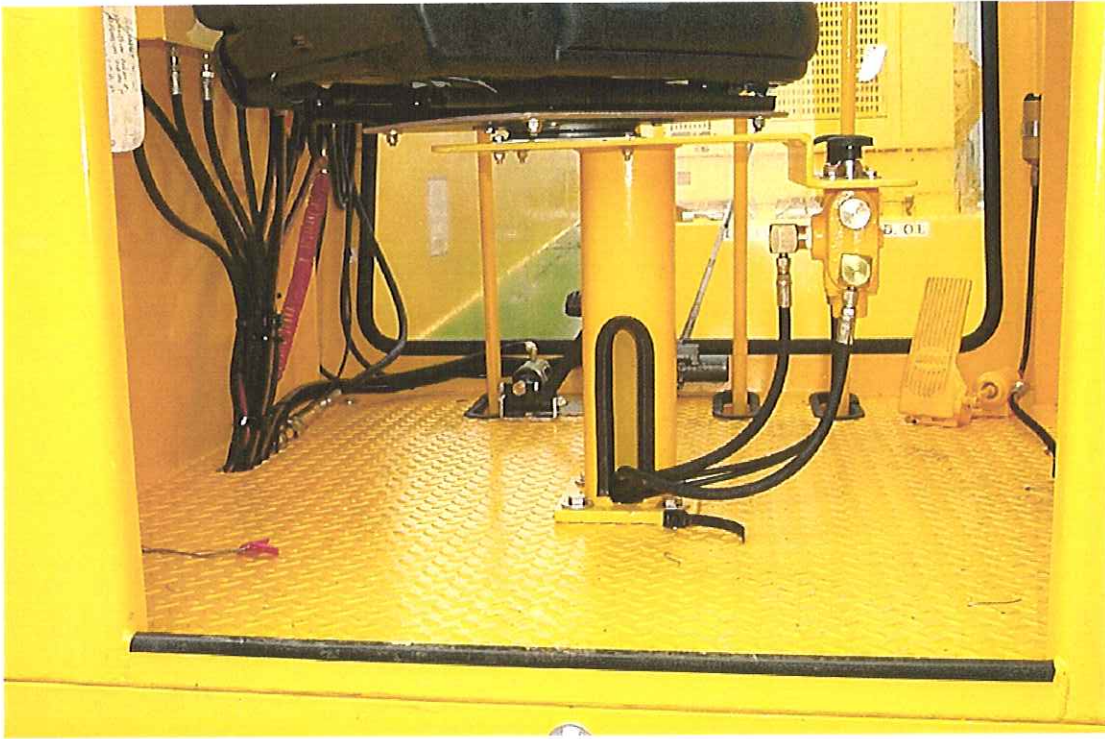
CAB ARRANGEMENT



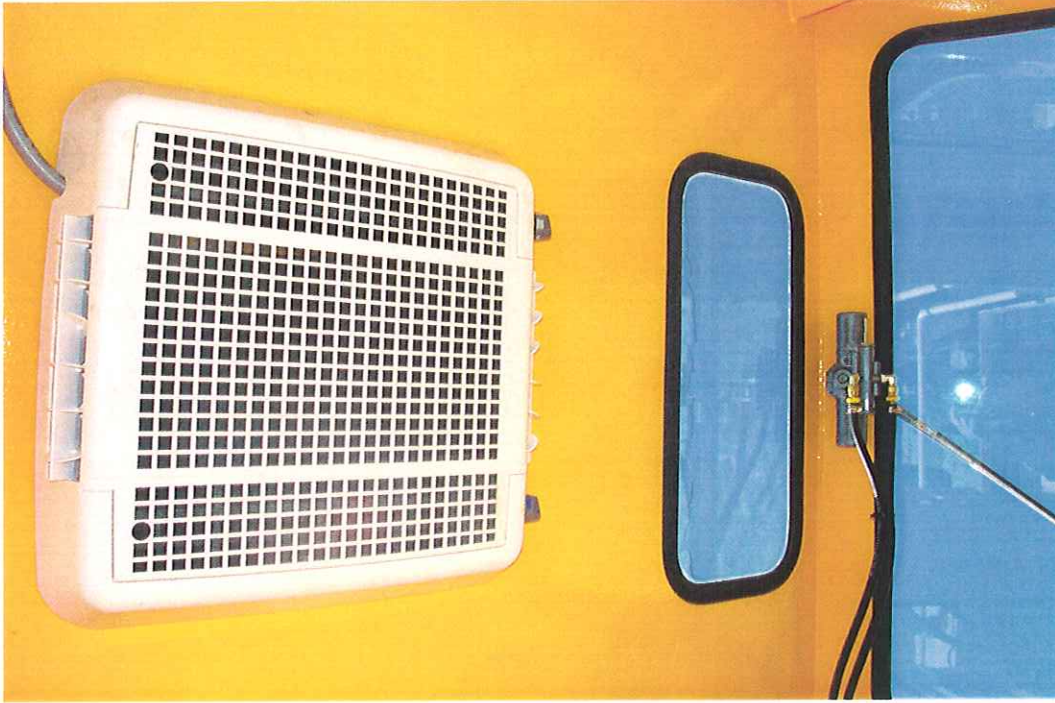
CAB ARRANGEMENT



CAB ARRANGEMENT



CAB ARRANGEMENT

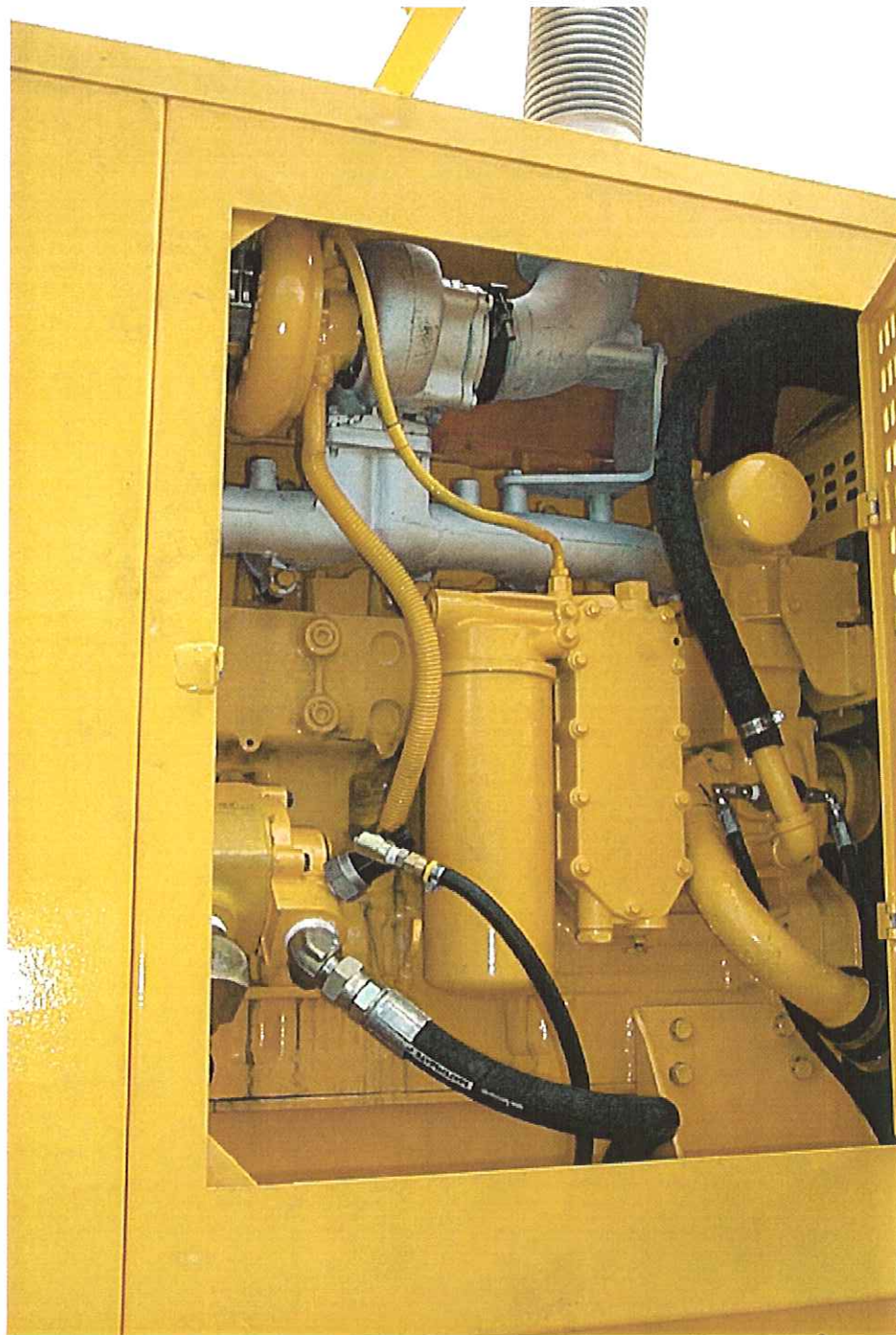


CAB ARRANGEMENT

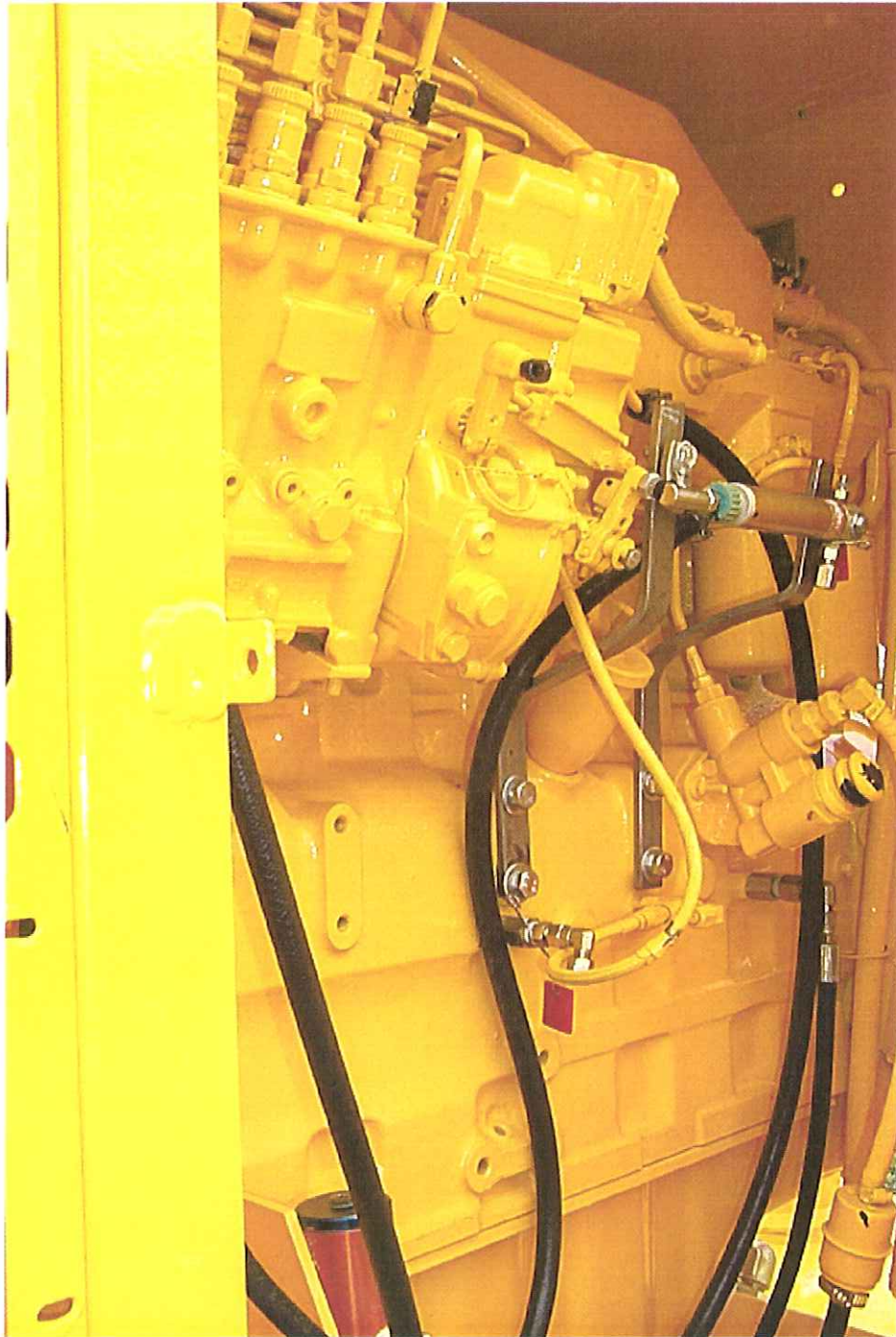
**POWER UNIT GENERAL
ARRANGEMENT DRAWING**



POWER UNIT



POWER UNIT



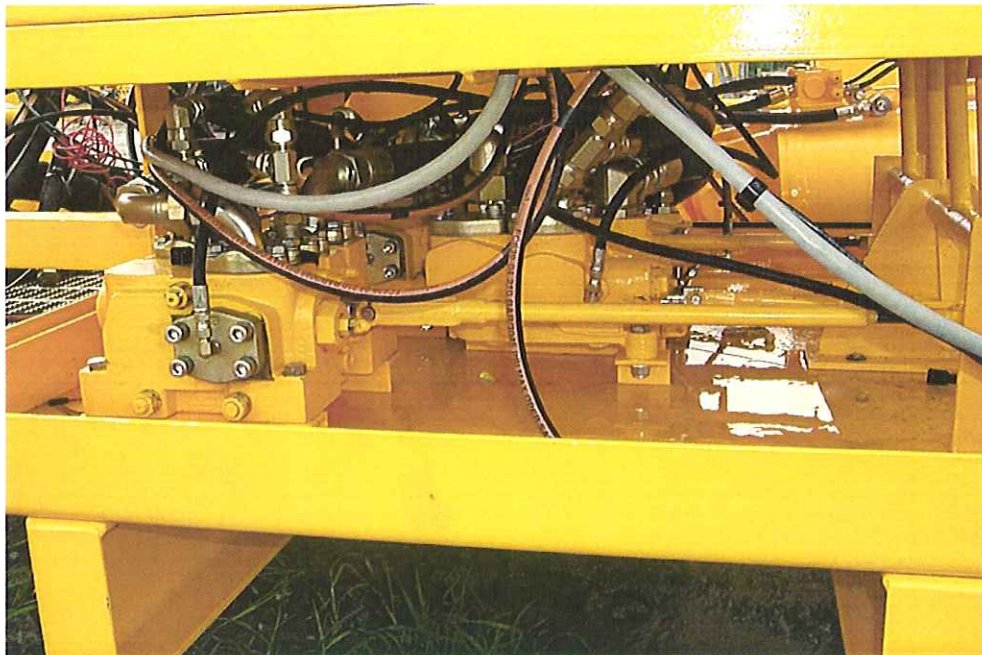
POWER UNIT

ENGINE OPERATIONS AND MAINTENANCE MANUAL

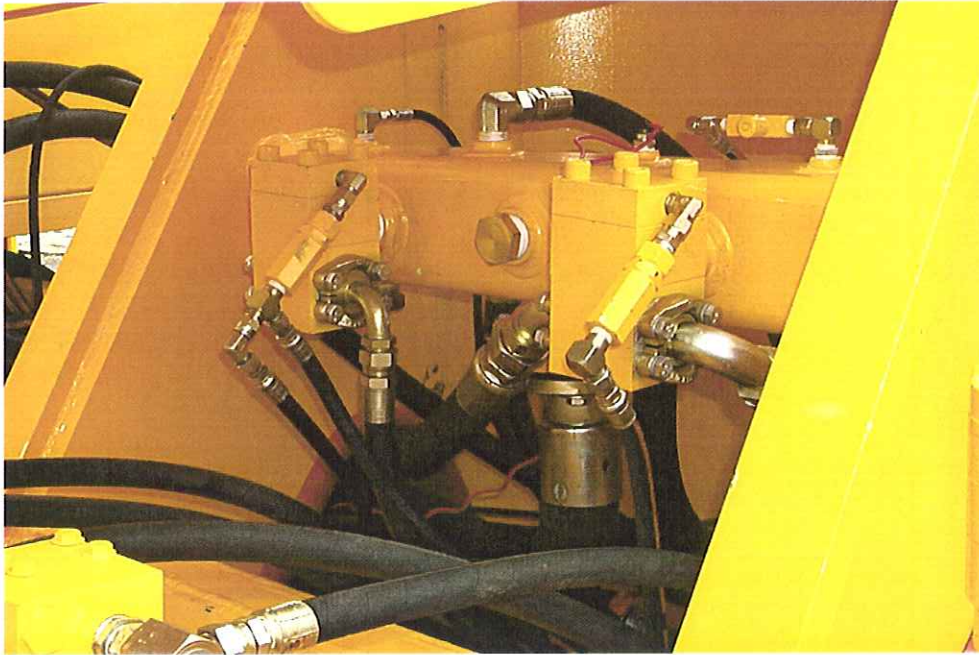
HYDRAULIC SCHEMATIC



HYDRAULIC SCHEMATIC



HYDRAULIC SCHEMATIC

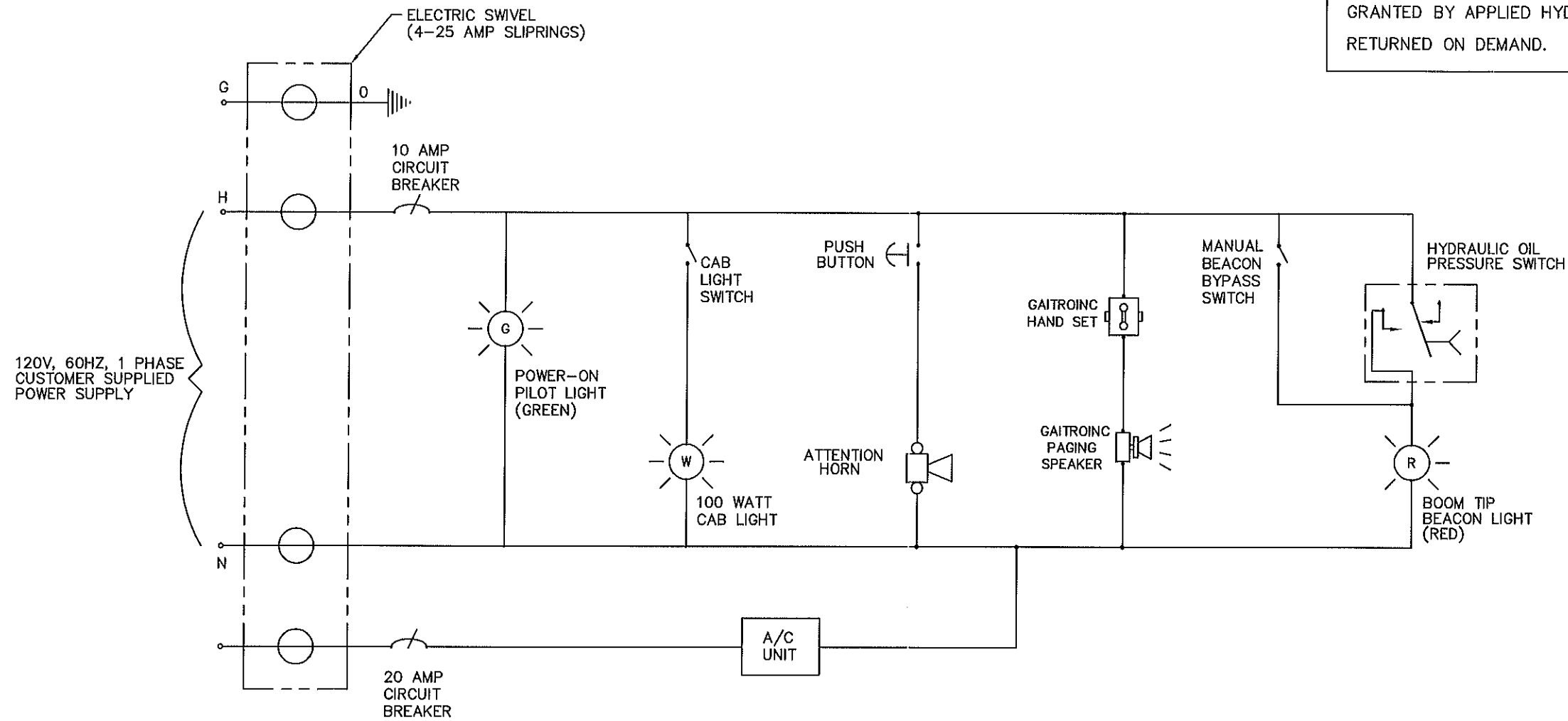


HYDRAULIC SCHEMATIC

ELECTRICAL SCHEMATIC

THIS DRAWING INCLUDING ALL NOVEL AND PATENTED OR PATENTABLE SUBJECT MATTERS EMBODIES CONFIDENTIAL INFORMATION OF APPLIED HYDRAULIC SYSTEMS, INC. AND IS LOANED WITH THE UNDERSTANDING THAT IT WILL NOT BE REPRODUCED NOR BE USED FOR ANY PURPOSE EXCEPT THAT FOR WHICH LOANED UNLESS WRITTEN PERMISSION IS GRANTED BY APPLIED HYDRAULIC SYSTEMS, INC. AND IT SHALL BE RETURNED ON DEMAND.

AUGUST 6, 2002

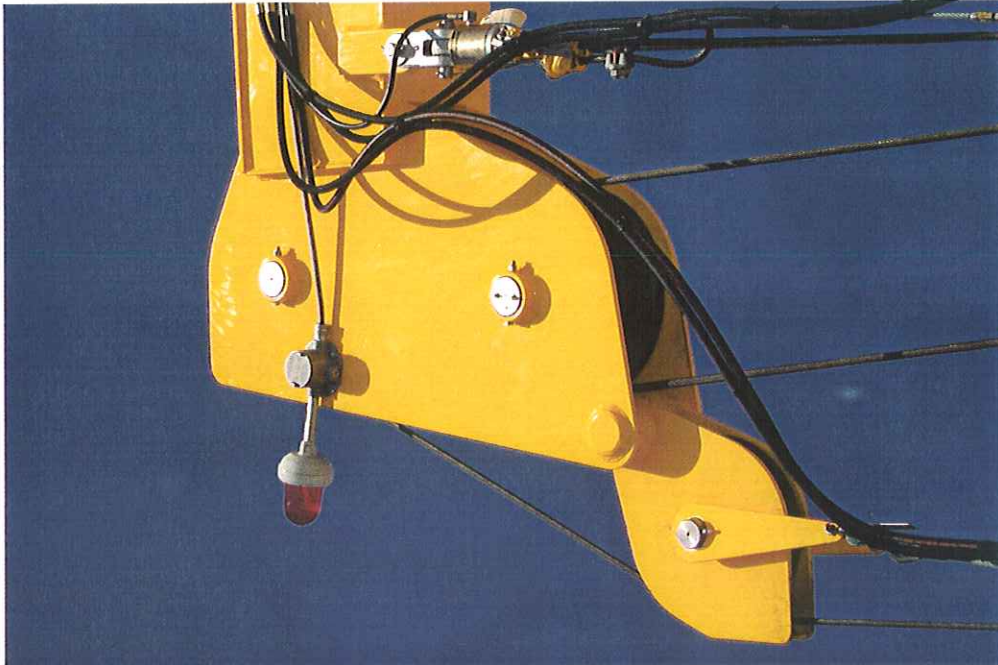


NOTE:

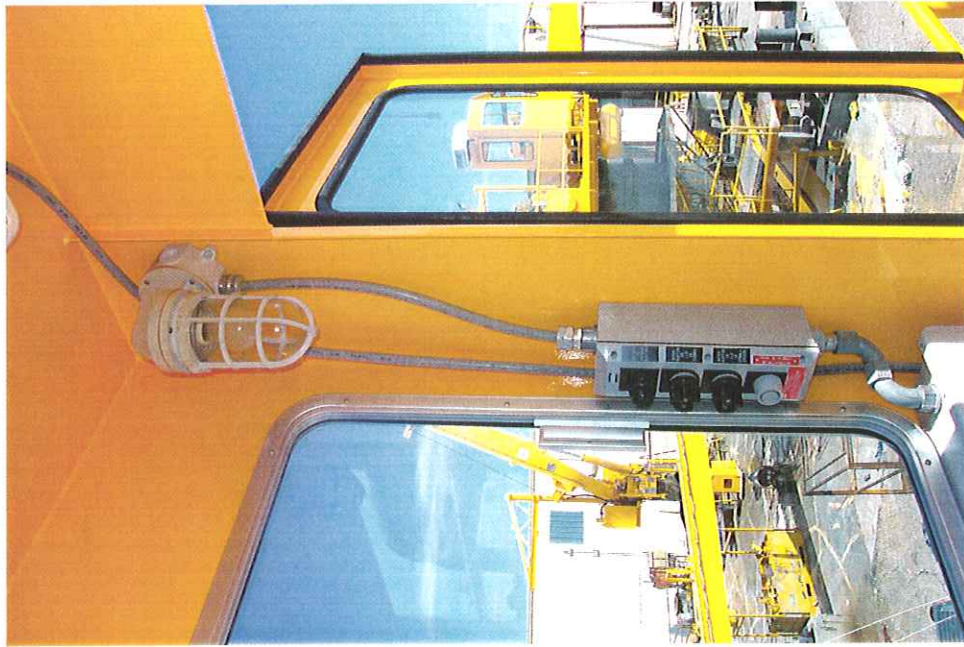
1. ALL ELECTRICAL ITEMS ARE MARINE DUTY.
2. 120 V, 60 HZ, 1 PHASE SYSTEM REQUIRED POWER SUPPLY.
3. ALL CABLE IS ARMORED SHIPBOARD CABLE WITH PVC JACKET.

SERIAL NO.: 020207, 020208, 020209
 PROJECT: PEMEX CANTARELL IPC 084

APPLIED HYDRAULIC SYSTEMS, INC.									
<p>Manufacturer of</p> <p>NAUTILUS</p> <p>Marine Cranes</p>									
Sales & Service (985) 851-5800 Fax No. (985) 851-0754					Manufacturing Plant 204 Industrial Ave. C Houma, LA 70363				
ELECTRICAL SCHEMATIC									
MODEL 180B-60									
PEMEX EXPLORATION									
DWG. NO. N2002SK1-089									
SCALE: NONE DWN BY: RON									
DATE: 3/11/02 APP'D BY: AS SHT. 1 OF 1									



ELECTRICAL SCHEMATIC



ELECTRICAL SCHEMATIC

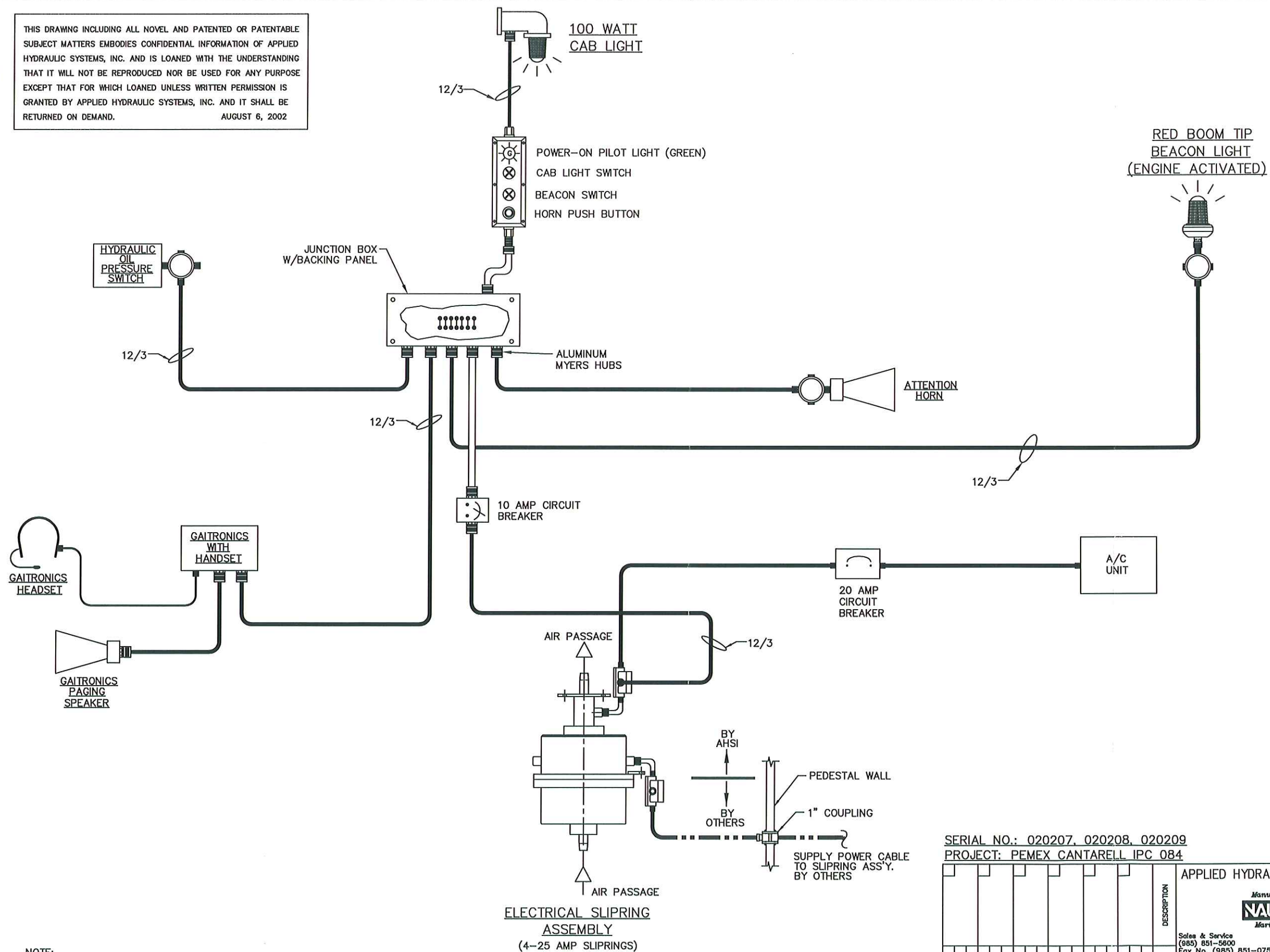


ELECTRICAL SCHEMATIC

ELECTRICAL WIRING DIAGRAM

THIS DRAWING INCLUDING ALL NOVEL AND PATENTED OR PATENTABLE SUBJECT MATTERS EMBODIES CONFIDENTIAL INFORMATION OF APPLIED HYDRAULIC SYSTEMS, INC. AND IS LOANED WITH THE UNDERSTANDING THAT IT WILL NOT BE REPRODUCED NOR BE USED FOR ANY PURPOSE EXCEPT THAT FOR WHICH LOANED UNLESS WRITTEN PERMISSION IS GRANTED BY APPLIED HYDRAULIC SYSTEMS, INC. AND IT SHALL BE RETURNED ON DEMAND.

AUGUST 6, 2002



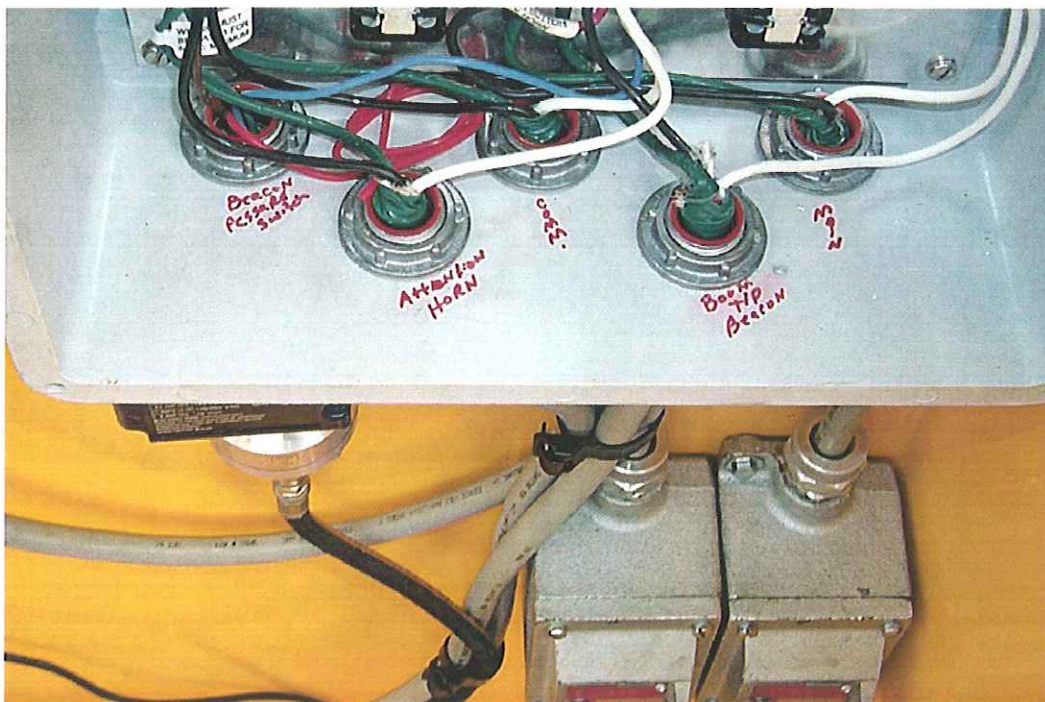
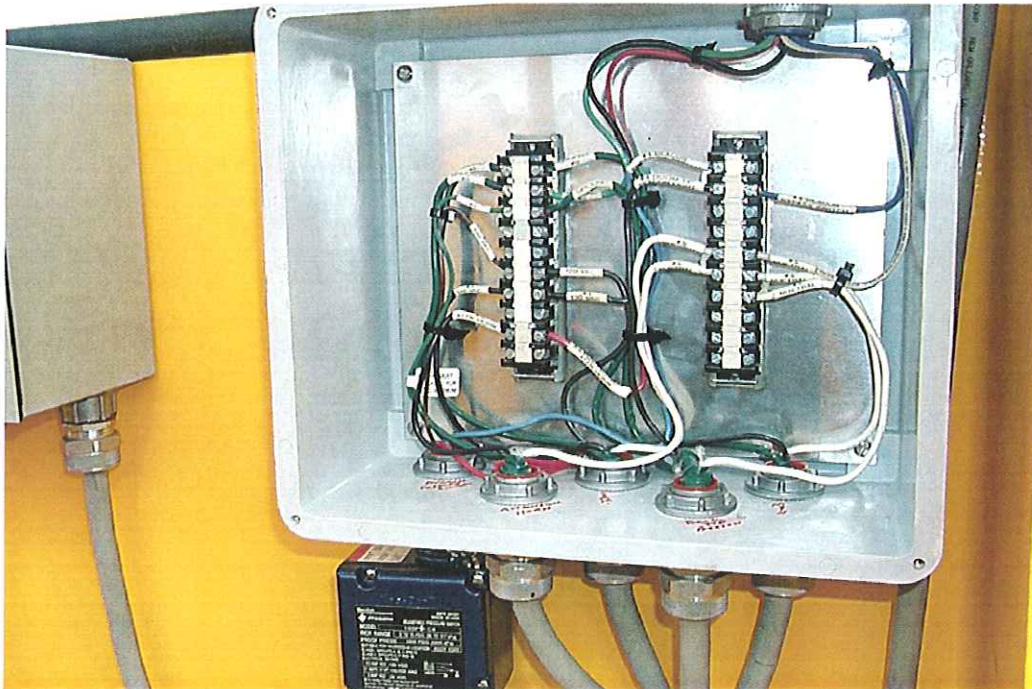
NOTE:

1. ALL ELECTRICAL ITEMS ARE MARINE DUTY.
2. 120 V, 60 HZ, 1 PHASE SYSTEM REQUIRED POWER SUPPLY.
3. ALL CABLE IS ARMORED SHIPBOARD CABLE WITH PVC JACKET.

SERIAL NO.: 020207, 020208, 020209
PROJECT: PEMEX CANTARELL IPC 084

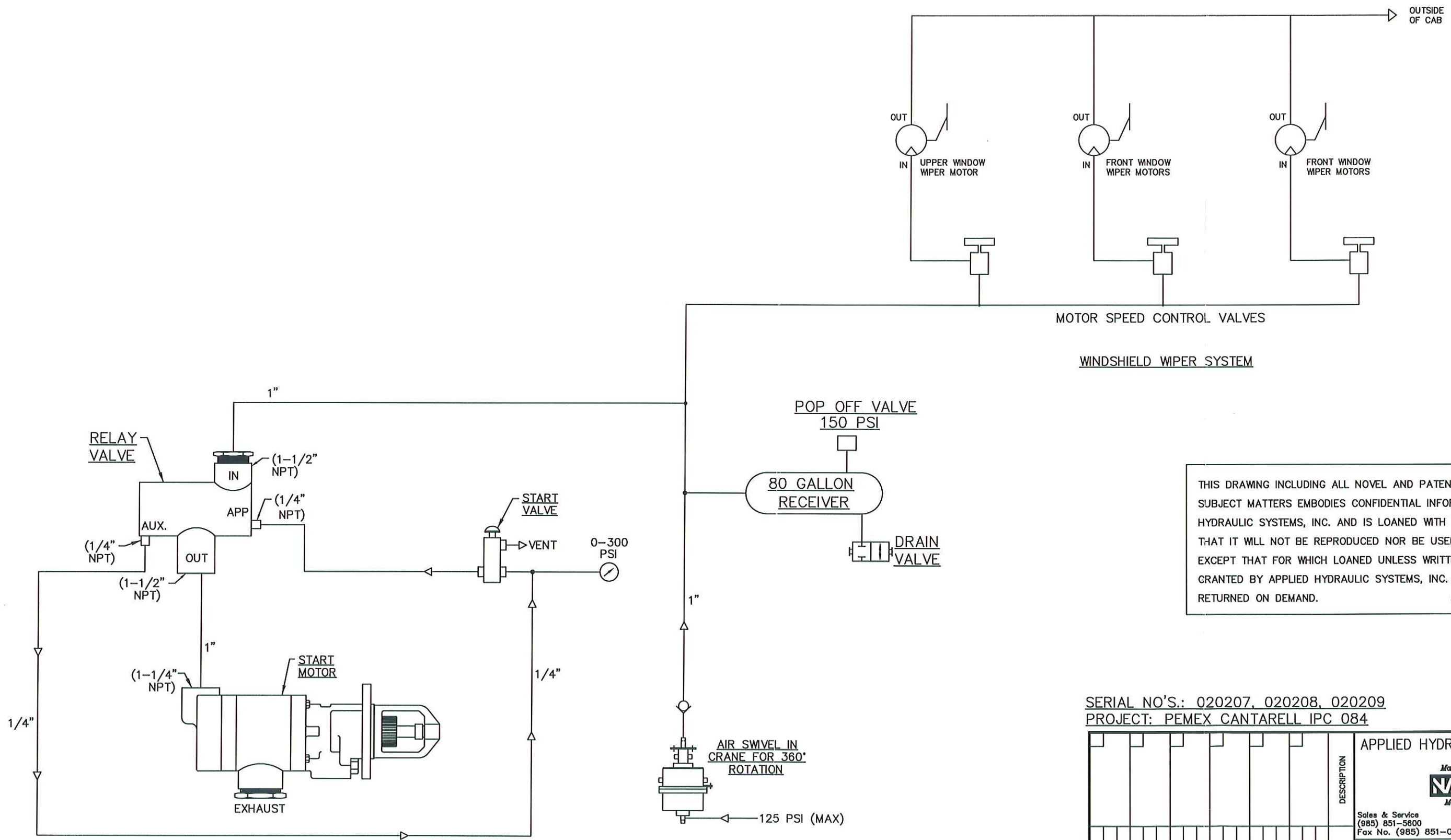
APPLIED HYDRAULIC SYSTEMS, INC.										DESCRIPTION	
										Manufacturer of NAUTILUS Marine Cranes	
										Sales & Service (985) 851-5600 Fax No. (985) 851-0754	
										Manufacturing Plant 204 Industrial Ave. C Houma, LA 70363	
										WIRING DIAGRAM MODEL 180B-60 PEMEX EXPLORATION	
										DWG. NO. M2002SK1-090	
										SCALE: NONE	
										DWN BY: RAY	
										DATE: 3/11/02	
										APP'D BY: [Signature]	
										SHT. 1 OF 1	

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ELECTRICAL WIRING DIAGRAM

AIR SCHEMATIC



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AUGUST 6, 2002

SERIAL NO'S.: 020207, 020208, 020209
PROJECT: PEMEX CANTARELL IPC 084

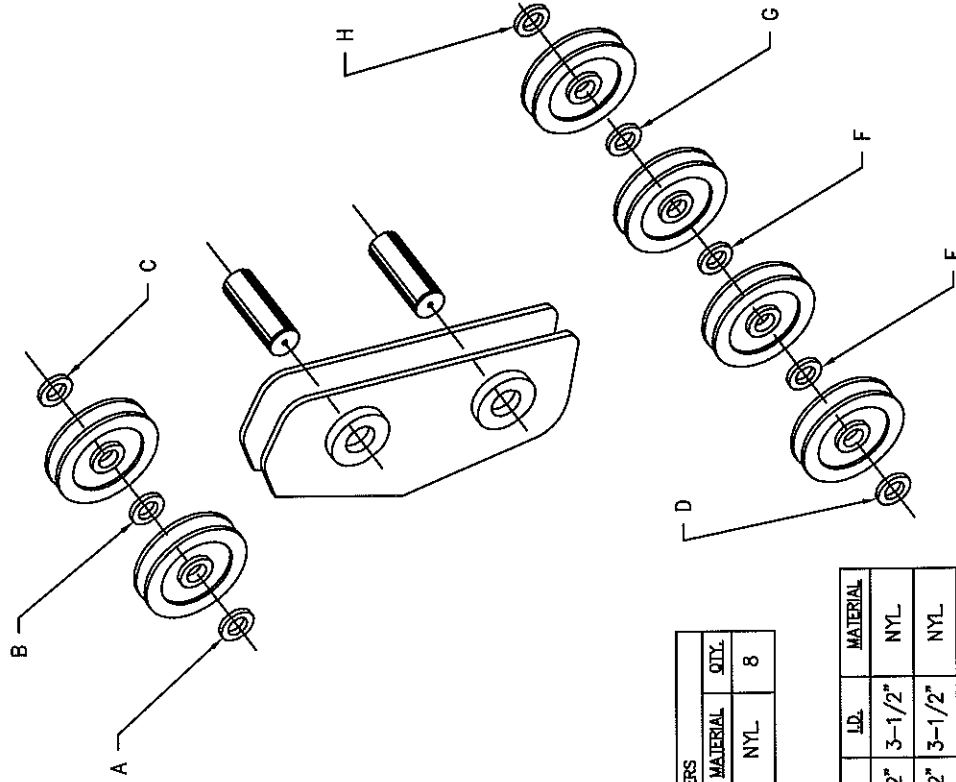
APPLIED HYDRAULIC SYSTEMS, INC.											
<div> <div> <div>Manufacturer of</div> <div>NAUTILUS</div> <div>Marine Cranes</div> </div> <div> <div>Sales & Service</div> <div>(985) 851-5600</div> <div>Fax No. (985) 851-0754</div> </div> <div> <div>Manufacturing Plant</div> <div>204 Industrial Ave. C</div> <div>Houma, LA 70363</div> </div> </div>											
<div> <div> <div>BY:</div> <div>APP'D:</div> <div>DATE:</div> </div> <div> <div>BY:</div> <div>APP'D:</div> <div>DATE:</div> </div> <div> <div>BY:</div> <div>APP'D:</div> <div>DATE:</div> </div> <div> <div>BY:</div> <div>APP'D:</div> <div>DATE:</div> </div> <div> <div>BY:</div> <div>APP'D:</div> <div>DATE:</div> </div> <div> <div>BY:</div> <div>APP'D:</div> <div>DATE:</div> </div> <div> <div>BY:</div> <div>APP'D:</div> <div>DATE:</div> </div> <div> <div>BY:</div> <div>APP'D:</div> <div>DATE:</div> </div> <div> <div>BY:</div> <div>APP'D:</div> <div>DATE:</div> </div> <div> <div>BY:</div> <div>APP'D:</div> <div>DATE:</div> </div> <div> <div>BY:</div> <div>APP'D:</div> <div>DATE:</div> </div> </div>											
<div> <div>DESCRIPTION</div> <div>AIR SCHEMATIC</div> <div>MODEL 180B-60</div> <div>PEMEX EXPLORATION</div> </div>											
<div> <div>DWG. NO.</div> <div>M2002SK1-088</div> </div>											
<div> <div>SCALE: NONE</div> <div>DWN BY: RON</div> </div>											
<div> <div>DATE: 3/11/02</div> <div>APP'D BY: </div> <div>SHT. 1 OF 1</div> </div>											

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SPACER KIT

SERIAL NUMBER: 020209C
CUSTOMER : PEMEX
CRANE MODEL : 180B-60

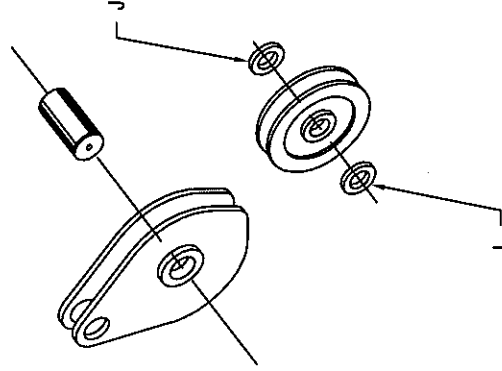
SPACER KIT



BEARING RETAINERS				
WIDTH	O.D.	I.D.	MATERIAL	QTY.
1/4"	5"	3-1/2"	NYL	8

SPACER	THICKNESS	O.D.	I.D.	MATERIAL
A	1/4"	5-1/2"	3-1/2"	NYL
B	1/4"	5-1/2"	3-1/2"	NYL
C	3-1/16"	5-1/2"	3-1/2"	NYL
D	N/A	N/A	N/A	N/A
E	N/A	N/A	N/A	N/A
F	1/8"	5-1/2"	3-1/2"	NYL
G	3-3/16"	5-1/2"	3-1/2"	NYL
H	3/16"	5-1/2"	3-1/2"	NYL

ISSUED BY : PATRICK PELTIER
DATE ISSUED : 6-13-02
COMPLETED BY : PATRICK PELTIER
DATE COMPLETED : 6-13-02



BEARING RETAINERS				
WIDTH	O.D.	I.D.	MATERIAL	QTY.
1/8"	3-3/4"	2-1/2"	NYL	2

SPACER	THICKNESS	O.D.	I.D.	MATERIAL
I	1/8"	4-1/2"	2-1/2"	NYL
J	1/8"	4-1/2"	2-1/2"	NYL

HYDRAULIC SYSTEM



SEE MAINTENANCE PRECAUTIONS
PRIOR TO PERFORMING ANY WORK.

HYDRAULIC SYSTEM - PART REPAIR OR REPLACEMENT -

Any repair of hydraulic parts, particularly pumps, motors and cylinders, requiring complete disassembly of the unit is not recommended to be performed in the field.

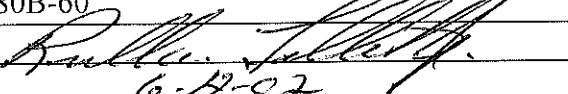
Major repairs should only be attempted by experienced, qualified and properly equipped personnel. Only minor repairs and adjustments as described in the manual should be performed in the field.

As always, the prime consideration when working on the hydraulic system is to insure that no contamination is introduced into the system. When replacing a hydraulic part, the following basic outline should be used:

1. Remove damaged part and install new part.
2. If any debris are present in the hoses or tubing, the lines should be flushed clean with a suitable solvent and blown dry before reconnecting.
3. If the hydraulic part is a pump or motor, power is off and disconnects are open. Physically hand-fill ports with clean hydraulic oil (Provides lubrication for initial start-up).
4. Reconnect all tubing and hoses.
5. If debris from damaged parts are in the system (such as motor which has "gone to pieces"), replace the return line filter element and check the suction strainers.
6. Check all mounting bolts, nuts and/or pins.
7. Start prime mover and allow it to run at low (idle) (1,000rpm).
8. Operate system at least a few minutes at zero pressure.
9. Operate repaired system without a load on the hood, observing operating pressure and general operational characteristics.
10. Operate system with a load, observing operating pressures and general operational characteristics.
11. Inspect the system for hydraulic leaks and correct any abnormalities.

MATERIAL CERTIFICATES

Material Traceability Log

CRANE WO. NO.:	020209
CUSTOMER:	S.W. PETROLEUM SERVICES/ PEMEX
WELDMENT PART NO.:	N2002SK1
WELDMENT S/N:	02079-03
DESCRIPTION:	Pedestal Weldment
MODEL:	180B-60
CHECKED BY:	
DATE:	6-8-02

[illegible]

To: Kury

NUCOR
PLATE MILL

P.O. Box 279
Winton, NC 27986
(252) 356-3700

Mill Test Report

Page 1



Issuing Date : 11/12/2001

B/L No. : 11884

Load No. : 13427

Our Order No. : 42151

Cust Order No. : 1060949

Specification : .5" x 96" x 240"

ASTM A36-00/ASTM A709 Grade 36-00/ASME SA36-96

Sold To : ONEAL STEEL INC
P O BOX 98

Ship To : ONEAL STEEL GREENSBORO
301 STANDARD DRIVE

Marking : 0426001 805829

BIRMINGHAM, AL 35201

GREENSBORO, NC 27409

Test Result Note:

Heat No.	C	Min	P	S	Si	Cu	Ni	Cr	Mo	Al	V	Nb (Cb)	Ti	N	Ca	B	Sn	Ceq	pcm
1103257	0.16	0.95	0.011	0.004	0.13	0.25	0.07	0.08	0.01	0.072	0.003	0.001	0.005	0.0000	0.0020		0.011	0.358	0.218
Tensile Test										Charpy Impacts (ft-lbs)									
Plate Serial No	Pieces	Yield (psi)	Tensile (psi)	Elongation (% in 2")	Elongation (% in 8")	Dir.	1	% shear	2	% shear	3	% shear	Ave.	Size	Temp.	Min	Ave		
1103257-01	3	44,900	68,900	24.2	24.2														
		47,100	70,300	24.3															

Manufactured to fully killed fine grain practice. Welding or weld repair was not performed on this material. Melted and manufactured in the USA. Yield by 0.5EU method.

Mercury has not been used in the direct manufacturing of this material.

$$Ceq = C + (Mn / 6) + ((Cr + Mo + V) / 5) + ((Cu + Ni) / 15)$$

$$Pcm = C + (Si / 30) + (Mn / 20) + (Cu / 20) + (Ni / 60) + (Cr / 20) + (Mo / 15) + (V / 10) + 58$$

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications.

T. A. Depretis

T. A. Depretis, Metallurgist

Rotek

CERTIFICATION OF TEST

CERTIFICATION NO. **A119293**

CUSTOMER ORDER NO.	ROTEK ORDER NO.	SPECIFICATION	DATE
042836	022160	ASTM A694-98A	10/11/00

APPLIED HYDRAULIC SYSTEMS
2204 INDUSTRIAL AVE. U
STATION 1, BOX 10155
MOBILE LA 70363

S
H
I
P

PART NO.	PCS	ROTEK HEAT CODE
MACHINED RING U1230758 67.000 56.000 X 3.000	6	Z175

HEAT NO.	MATERIAL VENDOR
10317	ELLWOOD QUALITY STEELS

CHEMICAL ANALYSIS

C	MN	P	S	SI	NI	CR	MO	CU	V	CB
.160	1.330	.008	.010	.250	.100	.090	.030	.090	.095	.027

MECHANICAL PROPERTIES OF TEST RING

BHN	TENSILE STRENGTH PSI	YIELD STRENGTH PSI	ELONG %	% RED. OF AREA	GRAIN SIZE
163	78,500	55,500	32	72	

CLEANLINESS RATING PER E-45

A	B	C	D
T H T H T H T H			

CHARPY IMPACT TEST RESULTS (FT. LBS.)

TEMP. ° F.	#1	#2	#3
0	117.0	123.0	108.0

ULTRASONIC INSPECTED

U.T. OK PER ASTM A388 (ST. BEAM)

HEAT TREATMENT

NORMALIZED 1700° F. 3-25 HOURS AIR COOL.

NOTES:

WE HEREBY CERTIFY THE ABOVE RESULTS ARE CORRECT AS REPORTED AND CONTAINED WITHIN COMPANY RECORDS.

Harry Friedman
QUALITY ENG
AUTHORIZED SIGNATURE

METALLURGICAL MANAGER

TITLE



U.S. STEEL GROUP
A DIVISION OF USS CORPORATION

TUBULAR PRODUCTS
CERTIFIED TEST REPORT

(TYPE B - IN ACCORDANCE WITH ISO 10474/EN10204/DIN5849)

DATE: 12/16/98
TIME: 14:47:27 USX™
USS, USX are trademarks of USS Corporation

MILL ORDER/ITEM NO. DR41891 03		SHIPPER'S NO.		PO NUMBER 3100		O.D.: 20.000(508.000)		I.D.: 1.031 (26.187)		WALL		IN (mm)	
MATERIAL COND.: AS ROLLED													
PRODUCT IDENTIFICATION		FLAT		BEND		GRAIN SIZE		MIN COLLAPSE		TEST LOC.		TEMP	
B69683		OK				** END OF DATA		THIS SHEET **		SIZE		TEST COND.	
										1		2	
										3		4	
										FT-LBS		% SHEAR	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
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										AVG		AVG	
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										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	
										3		4	
										AVG		AVG	
										1		2	

GLOBAL X-RAY & TESTING CORPORATION

JOEL MOREAU, President
Residence: 504-446-6861Post Office Box 1536
Morgan City, Louisiana 70381Bus: 504-631-2426
Fax: 504-631-0093

MT WORK REPORT

Report No. M
1123CLIENT Applied HydraulicsDATE 4/5/02CONTRACTOR PremierJOB LOCATION HARVEY, LA.JOB NO. WO# 020209CLIENT REPRESENTATIVE [Signature]MT TECH. Tommy PLAISANCEREMARKS MT Inspection

	WELD NO.	WALL THICKNESS	RECOMMENDATIONS				WELD NO.	WALL THICKNESS	RECOMMENDATIONS		
			✓	✗	REMARKS				✓	✗	REMARKS
1						51					
2						52					
3		100% MT Inspection				53					
4						54					
5		on CRANE pedestal				55					
6						56					
7						57					
8		1/2 20" MANWAY				58					
9						59					
10		2" 4" pad eyes				60					
11						61					
12		2" 1" TOL'S				62					
13						63					
14		1" 2" TOL				64					
15						65					
16						66					
17		All ACCEPTABLE				67					
18						68					
19						69					
20						70					
21						71					
22						72					
23						73					
24						74					
25						75					
26						76					
27						77					
28						78					
29						79					
30						80					
31											
32											
33											
34											
35											
36											
37											
38											
39											
40											
41											
42											
43											
44											
45											
46											
47											
48											
49											
50											

SURFACE CONDITION
 GOOD (✓) FAIR () PAINTED () WELD ()

EQUIPMENT
 MAKE Ferron MODEL E-50 SIN. 5045

CONTRACTS
 PROD SPACING 3" r.s. CONTINUOUS ()
 AC (✓) DC () HALF WAVE () FULL WAVE ()
 AMPS _____

MEDIA
 TC-BLACK WET (✓) BA-DRY () WHITE HIGHLIGHTER (✓)
 16AW

CALIBRATION
 10# WEIGHT LIFT () FLUX IND. CHECK ()
 CALIBRATION DATE: _____

ACCEPTANCE CRITERIA
AWS D11 Sec 6

TOTAL TIME HRS. 1 hr



GLOBAL X-RAY & TESTING CORPORATION

Post Office Box 1536
Morgan City, Louisiana 70381

JOEL MOREAU, President
Residence: 504-446-6861

Bus: 504-631-2426
Fax: 504-631-0083

UT WORK REPORT

TERMS AND ABBREVIATIONS

BT—BURN THROUGH
BTA—BURN THROUGH AREA
C—CRACK
IU—INTERNAL UNDERCUT
LC—LOW CROWN
LP—LACK OF PENETRATION
NF—NON FUSION
NW—NARROW WELD
OU—OUTSIDE UNDERCUT
P—POROSITY
SI—SLAG INCLUSIONS
SL—SLAG LINES

8678

CLIENT Applied Hydraulics DATE 4/5/02
CONTRACTOR Premier JOB LOCATION HARVEY, LA.
JOB NO. WOT# 020209 CLIENT'S REPRESENTATIVE [Signature]
UT TECH. Tommy Plaisance REMARKS UT Inspection

WELD NO.	WALL THICKNESS	RECOMMENDATION		REMARKS	WELD NO.	WALL THICKNESS	RECOMMENDATION		REMARKS
		✓ X	ACCEPT REJECT				✓ X	ACCEPT REJECT	
1					51				
2					52				
3					53				
4					54				
5					55				
6					56				
7					57				
8					58				
9					59				
10					60				
11					61				
12					62				
13					63				
14					64				
15					65				
16					66				
17					67				
18					68				
19					69				
20					70				
21					71				
22					72				
23					73				
24					74				
25					75				
26					76				
27					77				
28					78				
29					79				
30					80				
31									
32									
33									
34									
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40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									

EQUIPMENT

KRAUT KRAMER USK 7
TRANSDUCER (M H Z) 2.25 x 500 + 1"
ANGLE USED 0° 60° 70°
REFERENCE STANDARD AWS D11 Sec 6
ASME A 578 Level II

CALIBRATION

db Gain 80dB Sweep Delay
Zero Delay Reference Level 80dB

SUBSTANCES

AUTO TRANSPORTATION MILES

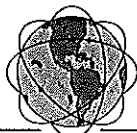
WATER TRAVEL TIME HRS.

LAND TRAVEL TIME HRS.

WORK TIME HRS.

STANDBY TIME HRS.

TOTAL TIME HRS. 2 hrs



GLOBAL X-RAY & TESTING CORPORATION

Post Office Box 1536
Morgan City, Louisiana 70381

JOEL MOREAU, President
Residence: 504-446-6861

DAILY NDE WORK REPORT TERMS AND ABBREVIATIONS

Bus: 504-631-2426
Fax: 504-631-0093

BT - BURN THROUGH
BTA - BURN THROUGH AREA
C - CRACK
IU - INTERNAL UNDERCUT

LC - LOW CROWN
LP - LACK OF PENETRATION
NF - NON FUSION
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P - POROSITY
SI - SLAG INCLUSIONS
SL - SLAG LINES

53067

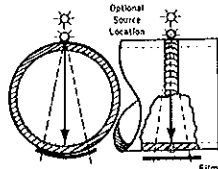
P# 58391

Customer Applied Hyd Contractor Premier
Address _____ Location of Job Harvey La.
Job No. 020209 W.O. _____ AFE _____ Other AWS DI.1
Job Specifications Gamma Ray Insp of 60" x 1" Crane rod 4/5

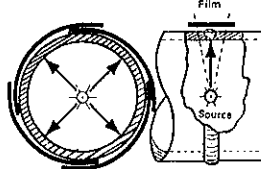
	WELD NO.	PIPE SIZE	RECOMMENDATIONS			WELD NO.	PIPE SIZE	RECOMMENDATIONS	
			✓	✗				✓	✗
1	LS1	60" x 1"				31			
2	2-1					32			
3	1-2					33			
4	2-3					34			
5	3-4					35			
6	4-5					36			
7						37			
8						38			
9						39			
10						40			
11						41			
12						42			
13						43			
14						44			
15						45			
16						46			
17						47			
18						48			
19						49			
20						50			
21						51			
22						52			
23						53			
24						54			
25						55			
26						56			
27						57			
28						58			
29						59			
30						60			

RADIOGRAPHIC SET-UP

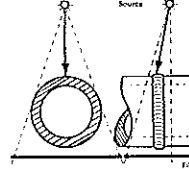
A Contact Method ☐



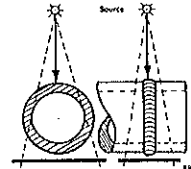
B Panoramic Method ☐



C Elliptical Method ☐

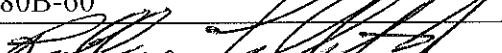


D Superimposed Method ☐



MAT'L _____ THICKNESS _____ DIAMETER _____ TECHNIQUE NO. _____
SOD _____ STRENGTH _____ SIZE _____ FILM _____ SCREENS _____
I.Q.I. _____ EXP. TIME _____ FILM PROCESSING _____ TEMP. _____
X-Ray _____ Gamma ☒ Other _____ Customer Representative [Signature]
No. of Welds Checked: 1 No. of Film/Holder: _____ Date 11-4-02
Linear Ft. Film 4x4x12 Type 4x4x10 Technician: S. Babine Level: II
Hours Worked: 1 hr Assistant: H. Leblanc
Stand-By Time: _____ Subsistence (check if applicable) _____ Assistant: _____
Travel Time: _____ Mileage _____ Unit No. _____

Material Traceability Log

CRANE WO. NO.:	020209
CUSTOMER:	S.W. PETROLEUM SERVICES/ PEMEX
WELDMENT PART NO.:	N61933-002
WELDMENT S/N:	02084-06
DESCRIPTION:	Turret Weldment
MODEL:	180B-60
CHECKED BY:	
DATE:	6-12-07

[illegible]

TO: APPLIED HYDRAULIC SYSTEMS, INC

AA PL#: MS6586

S.O.#: 199824

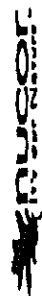
02/22/2002 From: AMERICAN ALLOY STEEL

P.O.#: 63439

Item: 2 (2 PC) 2" X 24" X 240"

: DROP FROM ITEM # 1

Mill Test Report



NUCOR
PLATE MILL

AMERICAN ALLOY
PLATE # MS6586

P.O. Box 279
Winton, NC 27986
(252)-356-3700

Date: 01-08-02 BIL No.: 14915 Load No.: 16526

Cust. Order No.: 230019-4

Our Order No.: 5390-10

Sold To:

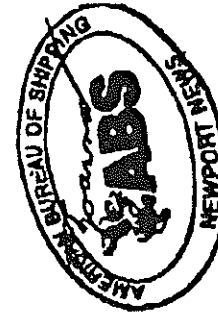
Specification: 2.000" x 120.000" x 480.000"

ASTM A36-00/ABS Grade A/ABS Grade B/ASME SA36-86

Heat No.	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al	V	Nb (Cb)	Ti	N	Ca	B	Sn	Ceq	Pcm
2100114	0.18	0.82	0.011	0.005	0.18	0.25	0.10	0.10	0.01	0.035	0.005	0.001							

Plate Serial No.	Tensile Test				Dir.	Charpy Impacts (ft-lbs)			Temp (°F)
	Places	Yield (psi)	Tensile (psi)	Elongation (% in 2")		Elongation (% in 8")	1	2	
2100114-03	3	43,800	74,500						
		44,900	72,400						

Certified a true copy of the
original, retained in our file.
AMERICAN ALLOY STEEL, INC.



Manufactured to a fully killed fine grain practice. Welding or weld repair was not performed on this material. Melting and manufacturing in the USA. Yield by .5EUL method. Mercury has not been used in the direct manufacturing of this material. Ceq=C+(Mn/16)+((Cr+Mo+V)/5)+((Cu+Ni)/16) b0m=C+(Si/20)+(Mn/20)+(Cu/20)+(Ni/20)+(Cr/20)+(Mo/15)+(V/10)+Sb

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications.

QB

T. A. Deprella
T. A. Deprella, Metallurgist

02/22/2002 From: AMERICAN ALLOY STEEL

To: APPLIED HYDRAULIC SYSTEMS, INC

P.O.# : 63439

S.O.# : 199824

AA PL#: MS6586

Item : 2 (2 PC) 2" X 24" X 240"

: DROP FROM ITEM # 1



Metallurgical Chemistry and Testing Laboratory

3204 BROADWAY (77017)
POST OFFICE BOX 282265
HOUSTON, TEXAS 77207-2265
PHONE: (713) 644-7501
FAX: (713) 644-1400
metaltesters@men.com

February 21, 2002

Page 1 of 1

American Alloy Steel, Inc.
Attn: Q.A. Department
P.O. Box 40460
Houston, TX 77240

P.O. No. 51871
Report No. 02-0413-2

IDENTIFICATION: 2" x 4" x 6", PLT#MS6586, HT# 2100114
MATERIAL: ASTM A36 OR EQUIVL, Mfg. Nucor
REFERENCE: S/O# 199824

IMPACT TEST

(Longitudinal)

10mm x 10mm CVN @ +10°F

<u>Foot Pounds</u>	<u>Lateral Expansion (mils)</u>	<u>% Shear</u>
80.0	63	50
75.0	59	50
79.0	63	50

MECH. TESTING - O.K.

DATE

BY

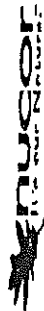
SC

Donald Derrick

Mechanical Testing Supervisor

Our letters and reports are for the exclusive use of the client to whom they are addressed. Our reports apply only to the actual sample tested and are not necessarily indicative of the properties of other identical or similar materials.

Mill Test Report



NUCOR
PLATE MILL

P.O. Box 279
Winton, NC 27986
(252)-356-3700

DEC-24-01 03:33 FROM

Date: 11/12/01 Brl No.: 11928 Load Req. No.: 13196 Our Order No.: 4247-1 Cust. Order No.: NEW-191199
Specification: .750" x 96.000" x 240.000
ASTM A36-00/ASTM A709 Grade 36-00/ASME SA3696
CHARPY V-NOTCH TESTED 15 FT LBS @ 10°F (FREQ H, LONG)
SolidNAMASCO Corporation Southwest
To: 4501 N. Miro Street
New Orleans, LA 70117
Ship To: 4501 N. Miro Street
New Orleans, LA 70117

Heat No.	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al	V	Nb (Cb)	Ti	N	Ca	B	Sn	Ceq	pcm
1103242	.20	.92	.009	.001	.26	.25	.06	.07	.00	.028	.004	.001							

Plate Serial No.	Tensile Test					Charpy Impacts (ft-lbs)							
	Pieces	Yield (psi)	Tensile (psi)	Elongation (% in 2")	Elongation (% in 8")	Dir.	1	2	3	Ave.	Size (mm)	Temp (°F)	Min Ave
1103242-03	8	48,100	75,100		23.4	L.	111.7	121.7	100.2	111.2	10.0	+10°F	15
		40,900	70,200		20.3								

+2523563903

T-034 P.003/003 F-944

Manufactured to a fully killed fine grain practice. Welding or weld repair was not performed on this material. Melted and manufactured in the USA. Yield by .5EUL method.
Mercury has not been used in the direct manufacturing of this material.
Ceq=C+(Mn/6)+((Cr+Mo+V)/5)+((Cu+Ni)/15)
pcm=C+(Si/20)+(Mn/20)+(Ni/60)+(Cr/20)+(Mo/15)+(V/10)+5B

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications.

T. A. Deprelis
T. A. Deprelis, Metallurgist

BETHLEHEM STEEL CORPORATION
QUALITY and PROCESS TECHNOLOGY
REPORT OF TESTS AND ANALYSES

BETHLEHEM LUKENS PLATE

SHIPMENT NO.

DATE SHIPPED

CATOR VEHICLE NO.

803-11120

04-25-01

NS-CHGD-UP

MTTX 097594 PAGE 2

AMERICAN ALLOY STEEL INC
900 BOX 40469
HOUSTON TX 77040-0469

APR 24 2002

AMERICAN ALLOY STEEL, INC
C/O RAMSAY SCARLETT & CO INC
PORT OF GREATER BATON ROUGE
TRACK #791
PORT ALLEN LA 70767

NOTE	SERIAL NUMBER	PAT. NO.	HEAT NUMBER	STEEL QUANTITY		LENGTH	WEIGHT	YIELD POINT	TENSILE STRENGTH	ELONG.		RED. %
				NO. PCS.	THICKNESS					IN	%	
					INCHES	INCHES	INCHES	POUNDS	PSI	PSI	IN	%
PRODUCED UNDER A CERTIFIED QMS COMPLYING WITH ISO 9002 QUALITY STEEL MELTED & MANUFACTURED IN THE U. S. A.												
PLATES - ABS GR DH36 KLD FINE GRAIN PRAC REV 2001, ABS GR DH36 REV 2001, ASTM A572-00 GR 50, CH-V L 25 FT LB AT -4F EA 50MT --- PLT CONTROL ROLL --- TEST CERTIFICATES ARE PREPARED IN ACCORDANCE WITH PROCEDURE OUTLINED IN DIN 50049 PARA 3.1B												
MFST - MFST TEST CERTIFICATES ARE PREPARED IN ACCORDANCE WITH PROCEDURE OUTLINED IN DIN 50049 PARA 3.1B LIFT MAX 10 TON UNLGD OH-SLING-PLATE CLAMP												
CO# 49103 GH 381-2329												
OUTSIDE INSPECTION BY AMERICAN BUREAU OF SHIPPING												
			833T67640	2	1.5	120	480	49006	62400 61900	83700 83700	2 2	31 30
			843P67130	1	1.5	120	480	24503	65200	84600	2	28
T-TEMPER TEMPERATURE												
H-NORMALIZE TEMPERATURE												
O-QUENCH TEMPERATURE												

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE BY THE BETHLEHEM STEEL CORP. TO THE APPLICABLE SPECIFICATION BY AN APPROVED PROCESS AND HAS BEEN TESTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE AMERICAN BUREAU OF SHIPPING RULES FOR THE INSPECTION AND TESTING OF MATERIALS TO THE SATISFACTION OF THE SURVEYORS.

BOILER & PRESSURE VESSEL SAFETY										CHARPY IMPACT											
SATISFACTION OF THE SURVEYORS																					
SERIAL NUMBER	PAT. NO.	HEAT NUMBER	HARD HBN	BEND	THICKNESS	TYPE	SIZE	ORL	TEST TEMP. F	ENERGY			SHEAR (%)			LAT. EXP.			MTLS		
					INCHES					1	2	3	1	2	3	1	2	3			
		833T67640			1.500	V	FULL	L	-4	185	152	130									
		843P67130			1.500	V	FULL	L	-4	133	134	114									
TEST REPORT APPROVED DATE										7-23-01											
AMERICAN ALLOY STEEL										D. Sullivan											
QUALITY ASSURANCE DEPT.																					

HEAT NUMBER	CHEMICAL ANALYSIS														CE
	C	Mn	P	S	N	CU	NI	CR	MO	V	TI	AL	SI	CO	
833T67640	.13	1.43	.015	.005	.007	.010	.01	.11	.057	.004	.002	.030	.0002	.031	.007
843P67130	.13	1.50	.023	.008	.028	.020	.01	.12	.059	.007	.002	.027	.0002	.033	.007
057-23 01															
Certified a true copy of the original, retained in our file.															
AMERICAN ALLOY STEEL, INC.															

I CERTIFY THAT THE ABOVE RESULTS ARE A TRUE AND CORRECT COPY OF ACTUAL RESULTS CONTAINED IN RECORDS MAINTAINED BY BETHLEHEM AND ARE IN FULL COMPLIANCE WITH THE REQUIREMENTS OF THE SPECIFICATION CITED ABOVE. THIS TEST REPORT CANNOT BE ALTERED AND MUST BE TRANSMITTED INTACT WITH ANY SUBSEQUENT THIRD PARTY TEST REPORTS, IF REQUIRED.

SUPERINTENDENT, QUALITY and PROCESS TECHNOLOGY D. J. FARRELL PER LDT

CUSTOMER Applied Hydraulic Sys
CUST P.O.# 64280
A.A.S. S/O 202330
DATE MAILED 4-16-02
DESCRIPTION #1(2) 1/2" X 96" X 2 1/2"

ORIGINAL FILED
BOSTON
DO NOT REMOVE
AMERICAN ALLOY
7-11-02 # C 65633

TO: APPLIED HYDRAULIC SYSTEMS, INC



TEST CERTIFICATE

CUSTOMER P.O.: 50354
DESCRIPTION: 1 - RECTANGLE 3 - X- 120 - X- 360
P.O. BOX 40469
ATTN: HOMER GARZA

AA PL#8020574

S.O.#: 199414

Item : 1 (3 PC) 3" X APPROX 71" O.D. X 54" I.D. PER DWG

DWG# N60065-080

02/07/2002 From: AMERICAN ALLOY STEEL

PAGE NO. 01 OF 02
FILE NO: 0284-01-11
DATE: 11/21/01
MILL ORDER NO: 32715-001

Bethlehem Steel
Bethlehem Lukens Plate

TEST CERTIFICATE
CUSTOMER P.O.: 50354
DESCRIPTION: 1 - RECTANGLE 3 - X- 120 - X- 360

SEND TO:
AMERICAN ALLOY STEEL, INC
P. O. BOX 40469
ATTN: HOMER GARZA

HOUSTON TX 77240-0469 HOUSTON TX 77240-0469 HOUSTON TX 77240

THIS MATERIAL HAS BEEN MANUFACTURED AND TESTED IN ACCORDANCE WITH PURCHASE ORDER REQUIREMENTS AND SPECIFICATIONS:

API 2H-8TH-EDITION GR 50 YR 99
SUPPL. PARA. S5 AND S12 APPLIES
TEST CERT. ARE PREPARED IN ACCORD. WITH PROCEDURES
ASTM A633 95 GR C, ASME SA537 ED 98 CL 1 MOD

CHEMICAL ANALYSIS

MELT/SLAB	C	MN	P	S	CU	SI	NI	CR	MO	V	TI	B	AL	CB	N	C.E. = 0.440
C3013	.14	1.53	.008	.001	.11	.35	.07	.13	.02	.001	.003	.0002	.033	.029	.0082	VIP
.C3013																FINELINE

OTHER TESTS PERFORMED

DRP WIGHTS - LOC:BL SIZE:P3 DEPTH:SURF (TEMPS)-30F -30F (RSLTS) NB NB
Certified a true copy of the original, retained in our file.
AMERICAN ALLOY STEEL, INC.

INFORMATION

WEIGHT PER PIECE = 36755 LBS. 16672 KG.
ALL STEEL HAS BEEN MELTED AND MANUFACTURED IN THE U.S.A.
A.B.S. Q.A. CERTIFICATE 00-QA1415-X.
MERCURY OR MERCURY COMPOUNDS ARE NOT USED IN THE MANUFACTURE OF BLP PRODUCTS.
MATERIAL HAS BEEN VACUUM DEGASSED AND CALCIUM TREATED FOR SULFIDE SHAPE CONTROL.
FINELINE MOD FOR SULPHUR
B/L #58213 NOKL 2903
MATERIAL PRODUCED UNDER A CERTIFIED QUALITY MANAGEMENT SYSTEM
COMPLYING WITH ISO 9002 ABS-QE CERTIFICATE NO. 30130

HEAT TREAT CYCLES - MATL OR TESTS - DEG FAHR

START TEMP	NOM TEMP	MIN TEMP	HOLD MINS	COOL METHOD	END TEMP
X	X	1650	0095	AC	

HEAT TREAT CYCLES - TESTS ONLY - DEG FAHR

START TEMP	NOM TEMP	MIN TEMP	HOLD MINS	HEAT RATE MAX	COOL RATE MAX

Elinore Japhtiny
SUPERVISOR - TEST REPORTING

REPORT #: TLN115

BETHLEHEM LUKENS PLATE
Q.A.-INSPECTION DEPARTMENT
UT NON-DESTRUCTIVE TESTING REPORT

DATE: 09/25/2001

CUSTOMER: AM.ALLOY STL-TX ORDER/ITEM NO: 32715 - 001 INSPECTOR: BRADLEY A CONQUEST
(LEVEL I SNT-TC-1A)

MATERIAL SPECIFICATION: API 2H-8TH-EDITION 99 50

CUST NO: 284 PURCH ORD NO: 50354

PART NO:

WITNESSED BY:

NDE SPEC: A578 85 L2 9" GRIDS

MARK NO:

GAUGE: 3.000000 WIDTH: 120.000000 LENGTH: 360.000000 UT: SB

DIV-LTR: X CHARGE: 38538 POS: 01 PATT: 001 MELT: C3013 SLAB: 04 COUPLANT: SOAP&WATER

EQUIPMENT USED: KK-USK7B SERIAL NUM: 86 CALIB DATE: 10/05/2001

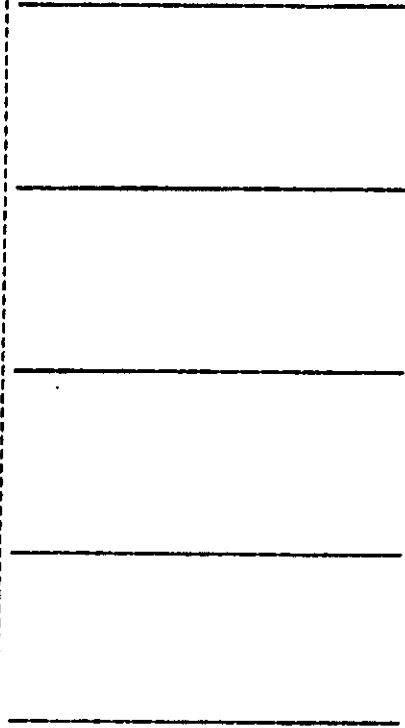
METHOD: CONTACT

AMPLITUDE: 75 GRID REF: 9"

TRANSDUCER: AEROTECH SIZE: 1.000

FREQ: 2.2500 TYPE OF SURFACE: AS ROLLED

LOC-1:



LOC-2

LOC-4

LOC-3:

HEREBY CERTIFY THAT THE ABOVE MATERIAL MEETS THE NON-DESTRUCTIVE TEST
REQUIREMENTS FOR THE ABOVE SPECIFICATION. KNOWINGLY OR WILLINGLY RECORDING
FALSE, FICTITIOUS, OR FRAUDULENT STATEMENTS ON ENTRIES ON THIS DOCUMENT MAY BE
PUNISHED AS A FELONY UNDER FEDERAL STATUTES INCLUDING FEDERAL LAW,
TITLE 18, CHAPTER 47.

MICHAEL HARTZ

INSPECTION SUPERVISOR
LEVEL II SNT-TC-1A

ID: 280169
HANNA

Hanna No.	Date	Page
-----------	------	------

Certification

808028

3/27/02

1

Shipped Hanna Steel Corporation
From: Tuscaloosa Division
1701 Boone Blvd
P O Box 428
Northport AL 35476

Cust P.O.: NEW207802
Date Shipped: 3/26/02
Load Tally 5-63091
Invoice # 709399

Send Namasco Corporation
To: Attn: Aura
500 Colonial Ctr Pkwy 500
Roswell GA 30076

Ship Namasco
To: 4501 North Miro
New Orleans LA 70117

No	Item	Heat #	ASTM	Year	Grade	Class	Yield	Tens	Elong	Rock
11	4705012		6X6 1/2"	GA A500	40.000FT		P/N 4705012			
2869570	B2M5164	A500	2001		B/C	1	53,000	70,000	27.5	B81
Total Weight		8,457								

Heat #	C	Mn	P	S	Si	Al	Cb	Cr	Cu	Mo	Ni	V
B2M5164	.050	.690	.011	.003	.020	.030	.000	.020	.110	.014	.050	.004

Heat# B2M5164 was melted and manufactured in the USA

11	7150412		2X3 RECT 1/4	HRA500	40.000FT							
2828424	AlY2183	A500	2001		B/C	1	66,000		69,000	25.6	B70	
2828424	AlY2188	A500	2001		B/C	1	66,000		69,000	25.0	B82	
Total Weight		5,680										

Heat #	C	Mn	P	S	Si	Al	Cb	Cr	Cu	Mo	Ni	V
AlY2183	.050	.700	.012	.008	.010	.036	.000	.030	.100	.007	.040	.020

Heat# AlY2183 was melted and manufactured in the USA

AlY2188	.060	.670	.016	.003	.010	.027	.000	.030	.140	.009	.050	.016
---------	------	------	------	------	------	------	------	------	------	------	------	------

Heat# AlY2188 was melted and manufactured in the USA

16	7830212		4X10 3/8GA	HRA500	40.000FT							
2817207	AlX2023	A500	2001		B/C	1	64,000		70,000	26.5	B86	
Total Weight		7,819										

Hanna Steel Corporation
3812 Commerce Avenue
Box 658
Irfield, Alabama 35064
205 780 1111
DUNS No. 00-402-9294

ID: 280169
HANNA

Hanna No.	Date	Page
-----------	------	------

Certification

.808028

3/27/02

2

Shipped Hanna Steel Corporation
From: Tuscaloosa Division
1701 Boone Blvd
P O Box 428
Northport AL 35476

Cust P.O.: NEW207802
Date Shipped: 3/26/02
Load Tally 5-63091
Invoice # 709399

Send Namasco Corporation
To: Attn: Aura
500 Colonial Ctr Pkwy 500
Roswell GA 30076

Ship Namasco
To: 4501 North Miro
New Orleans LA 70117

No	Item	Heat #	ASTM	Year	Grade	Class	Yield	Tens	Elong	Rock
16	7830212		4X10	3/8GA	HRA500		40.000FT			

CONTINUED

Heat #	C	Mn	P	S	Si	Al	Cb	Cr	Cu	Mo	Ni	V
AlX2023	.050	.700	.011	.003	.030	.037	.003	.070	.250	.023	.080	.017

Heat# AlX2023 was melted and manufactured in the USA

Hanna Steel Corporation
3812 Commerce Avenue
P O. Box 558
Field, Alabama 35064
780 1111
DUNS No. 00-402-9294

Randy Kirkland
Manager of QA
Hanna Steel Corporation



GLOBAL X-RAY & TESTING CORPORATION

Post Office Box 1536
Morgan City, Louisiana 70381

JOEL MOREAU, President
Residence: 504-448-8861

Bus: 504-631-2426
Fax: 504-631-0093

UT WORK REPORT

TERMS AND ABBREVIATIONS

BT—BURN THROUGH
BTA—BURN THROUGH AREA
C—CRACK
IU—INTERNAL UNDERCUT

LC—LOW CROWN
LP—LACK OF PENETRATION
NF—NON FUSION
NW—NARROW WELD

OU—OUTSIDE UNDERCUT
P—POROSITY
SI—SLAG INCLUSIONS
SL—SLAG LINES

8430

CLIENT Applied Hydraulics DATE 5/16/02
CONTRACTOR Premier JOB LOCATION HARVEY, LA.
JOB NO. WO# 020209 CLIENT'S REPRESENTATIVE [Signature]
UT TECH. Tommy Plaisance REMARKS UT Inspection

WELD NO.	WALL THICKNESS	RECOMMENDATION		REMARKS	WELD NO.	WALL THICKNESS	RECOMMENDATION		REMARKS
		✓ X	ACCEPT REJECT				✓ X	ACCEPT REJECT	
1					51				
2					52				
3					53				
4					54				
5					55				
6					56				
7					57				
8					58				
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EQUIPMENT
KRAUT KRAMER US107
TRANSDUCER (M H Z) 225 x 1.00
ANGLE USED 0
REFERENCE STANDARD ASTM A 578 Level D

CALIBRATION
db Gain 82B Sweep Delay 1009
Zero Delay 1009 Reference Level 1009

SUBSTANCES _____
AUTO TRANSPORTATION MILES _____
WATER TRAVEL TIME HRS. _____
LAND TRAVEL TIME HRS. _____
WORK TIME HRS. _____
STANDBY TIME HRS. _____
TOTAL TIME HRS. 1HR

GLOBAL X-RAY & TESTING CORPORATION

JOEL MOREAU, President
Residence: 504-446-6861Post Office Box 1536
Morgan City, Louisiana 70381Bus: 504-631-2426
Fax: 504-631-0093

MT WORK REPORT

Report No. M
1137

P#5839

CLIENT Applied Hydraulics DATE 5/10/02
 CONTRACTOR Premier JOB LOCATION HARVEY, LA.
 JOB NO. WO# 020209 CLIENT REPRESENTATIVE [Signature]
 MT TECH. Tommy Plaisance REMARKS MT Inspection

WELD NO.	WALL THICKNESS	RECOMMENDATIONS		REMARKS	WELD NO.	WALL THICKNESS	RECOMMENDATIONS		REMARKS
		✓ ACCEPT	✗ REJECT				✓ ACCEPT	✗ REJECT	
1					51				
2					52				
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4					54				
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100% MT Inspection
on Turret
4 Indications
Noted Repaired
+ R checked
Acceptable

SURFACE CONDITION
GOOD () FAIR () PAINTED () WELD ()

EQUIPMENT
MAKE Ferraro MODEL KSR S/N 5045

CONTRACTS
PROD SPACING 3" to 5" CONTINUOUS ()
AC () DC () HALF WAVE () FULL WAVE ()
AMPS _____

MEDIA
7C-BLACK WET () 8A-DRY () WHITE HIGHLIGHTER ✓

CALIBRATION
10# WEIGHT LIFT () FLUX IND. CHECK ()
CALIBRATION DATE: _____

ACCEPTANCE CRITERIA
AWS D1.1 6006

TOTAL TIME HRS. 2 hrs

GLOBAL X-RAY & TESTING CORPORATION

JOEL MOREAU, President
Residence: 504-446-6861

Post Office Box 1536
Morgan City, Louisiana 70381

Bus: 504-631-2426
Fax: 504-631-0093

MT WORK REPORT

Report No. M
1134

CLIENT Applied Hydraulics DATE 5/8/02
CONTRACTOR Premier JOB LOCATION HARVEY, LA.
JOB NO. WO# 020209 CLIENT REPRESENTATIVE [Signature]
MT TECH. Tommy Plaisance REMARKS MT Inspection

WELD NO.	WALL THICKNESS	RECOMMENDATIONS		REMARKS	WELD NO.	WALL THICKNESS	RECOMMENDATIONS		REMARKS
		✓ ACCEPT	✗ REJECT				✓ ACCEPT	✗ REJECT	
1					51				
2					52				
3					53				
4					54				
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50									

SURFACE CONDITION

GOOD (✓) FAIR () PAINTED () WELD ()

EQUIPMENT

MAKE Ferruss MODEL E.S. S/N 5055

CONTRACTS

PROD SPACING 3" to 5" CONTINUOUS ()
AC (✓) DC () HALF WAVE () FULL WAVE ()
AMPS _____

MEDIA

7C-BLACK WET (✓) 8A-DRY () WHITE HIGHLIGHTER (✓)

CALIBRATION

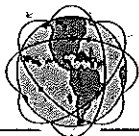
10# WEIGHT LIFT () FLUX IND. CHECK ()

CALIBRATION DATE: _____

ACCEPTANCE CRITERIA

AW 5 RTI Sec 6

TOTAL TIME HRS. 2 hrs



GLOBAL X-RAY & TESTING CORPORATION

Post Office Box 1536
Morgan City, Louisiana 70381

JOEL MOREAU, President
Residence: 504-446-8861

MT WORK REPORT

Bus: 504-631-2426
Fax: 504-631-0093

Report No. M 10691

P# 58391

CLIENT Applied Hydraulics DATE 5-30-02
CONTRACTOR Same JOB LOCATION Houma, LA.
JOB NO. _____ REMARKS MT Insp.
WO NO. 020209 AFE NO. _____ PO NO. _____
MT TECH Mitchell Nalient LEVEL II CLIENT REPRESENTATIVE [Signature]

WELD LOCATION AND IDENTIFICATION SKETCH

MT Insp. of turret

Quantity: _____		Total Accepted: _____			Total Rejected: _____			
	Weld Identification	Area Examined		Interpretation		Repairs		Remarks
		Entire	Specific	Accept.	Reject	Accept.	Reject	
1								
2	100% MT Insp. of swing drive Plate, Spill containment, Walkway Supports, and Recop welds							
3								
4								
5				✓				
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

PRE-EXAMINATION

Surface Preparation: Good

EQUIPMENT

Instrument Make: Parker

Model: B-300

S. No.: 7000

METHOD OF INSPECTION

☐ Dry ☒ Wet ☐ Visible ☐ Fluorescent

How Media Applied: Spray

☐ Residual ☒ Continuous ☐ True-Continuous

☒ AC ☐ DC ☒ Half-Wave

☐ Prods ☐ Yoke ☐ Cable Wrap ☐ Other _____

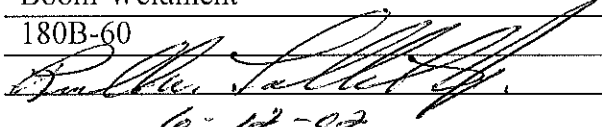
Direction for Field: ☐ Circular ☐ Longitudinal

Cleaning (if required): _____ Marking Method: _____

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared and tested in accordance with the requirements of AWS D11.1 Sec. 6.10 Ext. m Pwmm-001: Rev. 10

Travel Time _____ Mileage _____ Subsistence _____ Hours Worked 1hr

Material Traceability Log

CRANE WO. NO.: 020209
 CUSTOMER: S.W. PETROLEUM SERVICES/ PEMEX
 WELDMENT PART NO.: N61612-060
 WELDMENT S/N: 02084-05
 DESCRIPTION: Boom Weldment
 MODEL: 180B-60
 CHECKED BY: 
 DATE: 6-12-02

Material Description	Heat Number
Plate, A-514 (T-1) gr. B, 1/2" (Item 5)	107339
Plate, A-514 (T-1) gr. B, 1/2" (TRF, TMF, BAF, BFF)	368152
Plate, A-514 (T-1) gr. B, 1/2" (TFF)	114759
Plate, A-514 (T-1) gr. B, 1/2"	106354
Plate, A-514 (T-1) gr. B, 3/8" (LRW, LFW, RRW, RFW)	157045
Plate, ABS gr. DH 36, 1 1/2"	833T67640
Plate, ABS gr. DH36, 1"	W1L634
Plate, A-36, 1/4"	E2C108
Plate, A-36, 1/4"	B2A575
Plate, A-36, fine grain w/ charpy, 3/4"	1103242
Plate, A-36, fine grain w/ charpy, 3/8"	B0L559
Plate, A-36, fine grain w/ charpy, 1 1/4"	7454179
Angle, A-36, 1/4" x 2" x 2"	315-4170
Tube, mech., 1026, 8 1/2" x 5 1/2"	W0235
Tube, mech., 1026, 2 1/2" x 3 1/2"	J7469
Tube, mech., 1026, 5 1/2" x 4"	J7679
Tube, mech., 1026, 4" x 3"	0944399
Bar, flat, A-36, fine grain w/ charpy, 3/8"	98886

OREGON STEEL MILLS

P.O. BOX 2760, Portland, Oregon 97208 • (503) 286-9651 Fax (503) 240-5268

THE FIRST
ISO9002
REGISTERED
U.S. PATENT OFFICE

KLOCKNER NAWASCO CORPORATION
ATTN: STEPHANIE CHAMBERS
5775-C GLENRIDGE DRIVE, SUITE 110
ATLANTA, GA 30328

NAVASCO-SOUTHWEST
4501 N MIRO STREET
NEW ORLEANS, LA 70117-4439

REPORT OF CHEMICAL/PHYSICAL TESTS

CERTIFICATE NO. 619735	DATE Oct 02, 2000	PAGE 2
MILL ORDER NO. 122966	DATE	
CUSTOMER ORDER NO. NEW-148198		
JOB REQ. NO.		
SHIPPING NO. 619735	DATE 09/29/2000	
CARRIER UNION PACIFIC		
CARTRUCK NO. CW6090		

THIS MATERIAL HAS BEEN MANUFACTURED, TESTED AND FOUND TO MEET THE SPECIFICATIONS AND PURCHASE ORDER REQUIREMENTS
OSM ALLOY STRUCTURAL QUALITY PLATE ASTM A514-94A GR. B.

PHYSICAL PROPERTIES

Q&T (MIN)	DESCRIPTION	HEAT NO.	SLAB	YIELD PSI X 100	TENSILE PSI X 100	% ELONG 8" 2"	% RA	HARDNESS BRIN	BEND TEST	IMPACTS
1	0.5000 X 96.000 X 480.000 THE FOLLOWING PLATES WERE ALSTENITIZED AT 1680 DEGS F FOR 26 MINUTES AND AIR COOLED THEN TEMPERED AT 1260 DEGS F FOR 26 MINUTES AND AIR COOLED 1 PC 6534 LBS 00J3602 + 106347 E1 1090 1180 26 51 1 PC 6534 LBS 00J3603 + 106347 E1 1090 1180 27 51 1 PC 6534 LBS 00J3604 + 106347 E1 1080 1180 27 50 THE FOLLOWING PLATES WERE ALSTENITIZED AT 1680 DEGS F FOR 20 MINUTES AND WATER QUENCHED THEN TEMPERED AT 1260 DEGS F FOR 26 MINUTES AND AIR COOLED 1 PC 6534 LBS 00J4906 + 107339 A1 1080 1170 26 47 1 PC 6534 LBS 00J4907 + 107339 A1 1080 1170 28 53									
2	0.3750 X 96.000 X 480.000									

CHEMICAL ANALYSIS

HEAT NO.	C	Mn	P	S	Si	Cu	Ni	V	Cr	Al	Mo	Ti	B	Nb	Ca	CE
+106347	.18	.95	.006	.002	.32	.23	.08	.032	.030	.030	.52	.21	.030	.0127		
+107339	.19	.94	.005	.002	.35	.25	.09	.036	.028	.028	.55	.22	.030	.0122		
ALL HEATS INDICATED WITH (+) WERE MELTED AND MANUFACTURED IN THE USA.																

Kristine Hinkley
KRISTINE HINKLEY
Q.C. ENGINEER

I certify the above to be correct as contained in the records of OREGON STEEL MILLS BY

ID: 136194

INSPECTION SPECIALISTS, INC.

MECHANICAL TESTING LABORATORY DIVISION

5201 TARAVELLA ROAD • MARRERO, LA 70072-4240 • TEL: (504) 347-5600 • FAX: (504) 348-8001

806 E. MAIN STREET UNIT G • BROUSSARD, LA 70518 • TEL: (337) 837-2638 • FAX: (337) 839-2277

CERTIFICATE OF ANALYSIS

Client: Namasco Job No: 3119.90(1)

Client Representative: Lenny Dubrock Purchase Order: 5167073

Test Specification: ASTM A370

Sample Identification: One (1) - 1/2" x 96" x 480" Sample A514 Gr. B
Heat #107339

The above referenced sample was prepared and tested in accordance with the material requirements of ASTM A370. One (1) set of three (3) charpy v-notch impact test specimens were prepared and tested. The results of these tests are reported herein.

CHARPY V-NOTCH IMPACT TEST (10MM X 10MM X 55MM)

PECIMEN ID	FOOT POUNDS	LATERAL EXPANSION	PERCENT OF SHEAR
3119.90(1)-Base 1	120	46	70
3119.90(1)-Base 2	125	56	70
3119.90(1)-Base 3	131	48	70
AVERAGE	125.3	50.0	70.0

Test Temperature: 0°F

CERTIFIED BY:

Rodney C. Dufour
Rodney C. Dufour, Vice President - Operations

Date: August 1, 2001 Certificate No: 1 of 1

ALL TEST SPECIMENS, SAMPLES, DROPS, ETC. WILL BE DISCARDED THIRTY (30) DAYS AFTER TESTING UNLESS OTHERWISE INSTRUCTED IN WRITING.

VISUAL INSPECTION, NONDESTRUCTIVE AND DESTRUCTIVE TESTING SPECIALISTS

PORT OF DESTINATION	NEW ORLEANS	US UNITED STATES	000000000
REFERENCE	VESEL	INVOICE DATE	

E TESTADO NA PRODUÇÃO DE
NORRIS WETFORES
e the above mentioned material was tested in the presence of
our inspectors
SOCIEDADE REPRESENTATIVAS COM RESPONSABILIDADE LIMITADA (PRLA LT. 13)
the representative societies with authorization (Sheet No.)

24/08/01	20/08/01	24/08/01	20/08/01	07/10/01
----------	----------	----------	----------	----------

[illegible]

231	108113515	000	6532	6532	2963	2963	368128	75029705	TB	T C	N	712	779	91	30,0	0,49
231	108113523	000	6532	6532	2963	2963										
231	108113531	000	6532	6532	2963	2963										
212	108113555	000	6532	6532	2963	2963	368125+	75029802	TB	T C	N	794	849	94	28,0	0,47
212	108113566	000	6532	6532	2963	2963										
212	108113574	000	6532	6532	2963	2963										
211	108113590	000	6532	6532	2963	2963		75029801	TB	T C	N	695	768	90	30,0	0,46
211	108113604	000	6532	6532	2963	2963										
211	108113612	000	6532	6532	2963	2963										
212	109305469	000	6532	6532	2963	2963										
212	109305477	000	6532	6532	2963	2963	266056	75069003	TB	T C	N	767	817	94	27,0	0,49
212	109305485	000	6532	6532	2963	2963										

[illegible][illegible]

1

GOVERNIA DE LABOUR
LABOURERS AND NATURAL



P.O. Box 1900 PASCAGOULA MS 39568-1900

OFFICE: 228-762-2890 FAX: 228-769-5219

CERTIFICATE OF ANALYSISReport No. **272-2H**Page **1 of 1**Date **4/19/02**Lab No. **272-0402-9**

Material	A514	Thickness	0.500"	Dia.	----	HVID No.	368152
Material	----	Thickness	----	Dia.	----	HVID No.	----
Process	----	Filler Metal	----			Position	----
WPS	----			Welder	----	ID	----
From	Delta Steel and Subsidiaries			PO	----	Other	----
Test For	Charpy Impact					Test Date	4/19/02
Machine Model & Serial No.	Satec Systems (Baldwin) SI-1-C No. 1444						
Calibration Certified By	Nat'l Institute of Stds and Tech.					Date	8/7/01
Specification Followed	ASTM E-23 Figure 1 Type A						
Orientation of Specimens	<input type="checkbox"/> Transverse		<input checked="" type="checkbox"/> Longitudinal		Size	10mm X 10mm X 55mm	

CHARPY IMPACT TEST RESULTS

Specimen No.	Notch Location	Notch Type	Test Temperature	Impact Values (ft. lbs.)	% Shear	Mil Lateral Exp.	Joules
9 B 1	Base	V	0 °F	64	----	----	----
9 B 2		V	0 °F	64	----	----	----
9 B 3		V	0 °F	47	----	----	----

We certify that the statements in this record are correct and that the test samples were prepared and testing accordance with the requirements of Techweld PMT Procedure No. 1, ASTM E-23.

Test materials will be discarded after 90 days unless prior written notification is received.

Certified By

QC 1
JOHN C. TAYLOR
ID# 10411
Techweld, Inc.
CW1

Date **4-19-02**



P.O. Box 1900 PASCAGOULA MS 39568-1900

OFFICE: 228-762-2890 FAX: 228-769-5219

CERTIFICATE OF ANALYSISReport No. **272-2C**Page **1 of 1**Date **4/19/02**Lab No. **272-0402-3**

HT# 368125

Material	A514	Thickness	0.375"	Dia.	---	HVID No.	368125
Material	---	Thickness	---	Dia.	---	HVID No.	---
Process	---	Filler Metal	---			Position	---
WPS	---			Welder	---	ID	---
From	Delta Steel and Subsidiaries			PO	---	Other	---
Test For	Charpy Impact					Test Date	4/19/02
Machine Model & Serial No.	Satec Systems (Baldwin) SI-1-C No. 1444						
Calibration Certified By	Nat'l Institute of Stds and Tech.						Date 8/7/01
Specification Followed	ASTM E-23 Figure 1 Type A						
Orientation of Specimens	<input type="checkbox"/> Transverse <input checked="" type="checkbox"/> Longitudinal						Size 10mm X 7.5mm X 55mm

CHARPY IMPACT TEST RESULTS

Specimen No.	Notch Location	Notch Type	Test Temperature	Impact Values (ft. lbs.)	% Shear	Mil Lateral Exp.	Joules
3 B 1	Base	V	0 ° F	118	---	---	---
3 B 2		V	0 ° F	108	---	---	---
3 B 3		V	0 ° F	109	---	---	---

We certify that the statements in this record are correct and that the test samples were prepared and testing accordance with the requirements of Techweld PMT Procedure No. 1, ASTM E-23.

Test materials will be discarded after thirty (30) days unless prior written notification is received.

Certified By

JOHN C. TAYLOR

 24040411

 Techweld, Inc.

Date **4-19-02**

CHAPEL STEEL CO.
DELTA STEEL
PLATE A514 GRADE B
1/2" X 24"000" X 120'000"
BARENO

PO/Rel DHO-11973-JLEEN

Certificate of Mill Test Results
SO HOU-00983
23Apr02
Pg.1/2

ALUM.

OREGON STEEL MILLS

P.O. BOX 2760, Portland, Oregon 97208 • (503) 286-9651 Fax (503) 240-5268



CHAPEL STEEL CO-BIRMINGHAM
414 COMMERCE DRIVE, SUITE 150
P.O. BOX 7537
FORT WASHINGTON, PA 19034

CHAPEL STEEL CO-BIRMINGHAM
414 COMMERCE DRIVE, SUITE 150
P.O. BOX 7537
FORT WASHINGTON, PA 19034

CUSTOMER ORDER NO.
BRM-1249

JOB/REL NO.

SHIPPING NO.
693354

DATE
02/21/2002

THIS MATERIAL HAS BEEN MANUFACTURED, TESTED AND FOUND TO MEET THE SPECIFICATIONS AND PURCHASE ORDER REQUIREMENTS
OSM ALLOY STRUCTURAL QUALITY PLATE ASIM A514-94A GR B.

CARRIER
BURLINGTON NORTHERN
CAR/TRUCK NO.

FOUR

REPORT OF CHEMICAL/PHYSICAL TESTS

CERTIFICATE NO.	DATE	PAGE
693354	Feb 21, 2002	1
MILL ORDER NO.	DATE	
140142		
CUSTOMER ORDER NO.		
BRM-1249		
JOB/REL NO.		
SHIPPING NO.	DATE	
693354	02/21/2002	
CARRIER		
BURLINGTON NORTHERN		
CAR/TRUCK NO.		

PHYSICAL PROPERTIES

DESCRIPTION	HEAT NO.	SLAB	YIELD PSI X 100	TENSILE PSI X 100	% ELONG 8" 2"	% RA	HARDNESS BHN	BEND TEST	IMPACTS
2 0.5000 X 96.000M X 240.000 THE FOLLOWING PLATES WERE AUSTENITIZED AT 1680 DEGS F FOR 26 MINUTES AND WATER THEN TEMPERED AT 1260 DEGS F FOR 27 MINUTES AND AIR COOLED 1 PC 3267 LBS 02A3523 + 114746 E1 1 PC 3267 LBS 02A3523 + 114746 E1			1040 1040	1140 1140	28 28	60 60			QUENCHED
THE FOLLOWING PLATES WERE AUSTENITIZED AT 1680 DEGS F FOR 21 MINUTES AND WATER THEN TEMPERED AT 1260 DEGS F FOR 26 MINUTES AND AIR COOLED 1 PC 3267 LBS 02A3524 + 114746 E1			1050	1140	31	56			QUENCHED
THE FOLLOWING PLATES WERE AUSTENITIZED AT 1680 DEGS F FOR 20 MINUTES AND WATER THEN TEMPERED AT 1260 DEGS F FOR 26 MINUTES AND AIR COOLED 1 PC 3267 LBS 02A3529 + 114759 C1 1 PC 3267 LBS 02A3529 + 114759 C1 1 PC 3267 LBS 02A3530 + 114759 C1 1 PC 3267 LBS 02A3530 + 114759 C1			1070 1070 1100 1100	1170 1170 1190 1190	27 27 28 28	52 52 54 54			QUENCHED

CHEMICAL ANALYSIS

HEAT NO.	C	Mn	P	S	Si	Cu	Ni	V	Cr	Al	Mo	Ti	B	N	Ca	CE
+114746	.18	.94	.006	.003	.30	.21	.08	.036	.027	.53	.23	.029	.0026	.0095		
+114759	.18	.90	.005	.004	.31	.27	.11	.035	.034	.55	.22	.028	.0018	.0075		
HEATS INDICATED WITH (+) WERE MELTED & MANUFACTURED IN THE USA. ALL OTHER HEATS WERE ROLLED IN THE USA.																

I certify the above to be correct as contained in the records of OREGON STEEL MILLS By

Christine Williams
CHRISTINE WILLIAMS
Q.C. RECORDS ADMINISTRATOR

OREGON STEEL MILLS

P.O. BOX 2760, Portland, Oregon 97208 • (503) 286-9651 Fax (503) 240-5268

REPORT OF CHEMICAL/PHYSICAL TESTS

CERTIFICATE NO. 693354 DATE Feb 21, 2002 PAGE 2



SOLD TO

CHAPLAIN STEEL CO-BIRMINGHAM
414 COMMERCE DRIVE, SUITE 150
P.O. BOX 7537
FORT WASHINGTON, PA 19034CHAPLAIN STEEL CO-BIRMINGHAM
414 COMMERCE DRIVE, SUITE 150
P.O. BOX 7537
FORT WASHINGTON, PA 19034THIS MATERIAL HAS BEEN MANUFACTURED, TESTED AND FOUND TO MEET THE SPECIFICATIONS AND PURCHASE ORDER REQUIREMENTS
OSM ALLOY STRUCTURAL QUALITY PLATE ASTM A514-94A GR. B.MILL ORDER NO. 140142
CUSTOMER ORDER NO. BRM-1249
JOB/REL NO.
SHIPPING NO. 693354 DATE 02/21/2002
CARRIER BURLINGTON NORTHERN
CAR/TRUCK NO.**PHYSICAL PROPERTIES**

CSA ITEM#	DESCRIPTION	HEAT NO.	SLAB	YIELD PSI X 100	TENSILE PSI X 100	% ELONG 8" 2"	% RA	HARDNESS BHN	BEND TEST	IMPACTS
--------------	-------------	----------	------	--------------------	----------------------	------------------	------	-----------------	--------------	---------

7 PCS 22869 LBS TOTALS

CHEMICAL ANALYSIS

HEAT NO.	C	Mn	P	S	Si	Cu	Ni	V	Cr	Al	Mo	Ti	B	Nb	Ca	CE	Microalloy Grain Size
.....	END OF REPORT														

I certify the above to be correct as contained in the records of OREGON STEEL MILLS By


CHRISTINE WRINKLE

Phone: 281-449-5228

The Quality Source

**14610 Sheraton
Houston, TX 77039**

Charpy Impact Test Report

Date Received:	04/23/2002	Specification:	A370	Rev.	96	Report#:	020361					
Date Completed:	04/25/2002	Procedure:		Rev.		Revision:	0					
Customer:		Deviations:	N/A			P.O.#:	D1565-142620					
Delta Steel Inc.		Temperature Measuring Device:	Tegam			Page 1 of 1						
Address:		Serial #:	T-159722			Direction:	LCVN					
P.O. Box 2289 Houston, TX 77252		Cal Due:	01/08/2003			Temperature:	0 F					
Material Tested	Size	Results	Slab #	Heat #	Units	A	B	C	Avg.			
A514 B	1/2" Plate	Pass	N/A	114759-C1	FT/LB	122	130	139	130.3			
A514 B	1/2" Plate	Pass	N/A	114759-C1	FT/LB	128	140	135	134.3			
A514 B	1/2" Plate	Pass	N/A	114759-C1	FT/LB	160	161	154	158.3			
Additional Data	Percent Shear				Lateral Expansion							
Material Tested	A	B	C	Avg.	A	B	C	Avg.				
A514 B	70%	85%	85%	80%	0.074	0.081	0.083	0.079				
A514 B	75%	85%	80%	80%	0.081	0.085	0.083	0.083				
A514 B	100%	100%	100%	100%	0.088	0.090	0.088	0.089				
Comments:	Impact Tester:				SI-1K3							
	Serial #:				1768							
	Calibration Due:				01/09/2003							
All tests are performed using calibrated equipment on samples provided by the customer above, unless noted in the data section. This data applies only to samples tested by TQS, Inc. This test report may be reproduced in its entirety without permission from TQS, Inc. All requirements of TQS, Inc. Quality Assurance Program, Rev. A, Dated 7/10/96 have been fulfilled.												
Inspected by:	J.R. Harris	Date:	04/25/2002									
Signature:												

CC99666T97

06:11 7007. / 07. / 08

OREGON STEEL MILLS

P.O. BOX 2760, Portland, Oregon 97208 • (503) 286-9651 Fax (503) 240-5268

THE FIRST
ISO9002
REGISTERED
PLATE PROGRAM

KLOCKNER NAMASCO CORPORATION
ATTN:STEPHANIE CHAMBERS
5775-C GLENRIDGE DRIVE, SUITE 110
ATLANTA, GA 30328

NAMASCO-SOUTHWEST
4501 N MIRO STREET
NEW ORLEANS, LA 70117-4439

RECEIVED OCT 6 2000

REPORT OF CHEMICAL/PHYSICAL TESTS

CERTIFICATE NO.	DATE	PAGE
619734	Sep 29, 2000	1
MILL ORDER NO.	DATE	
122965		
CUSTOMER ORDER NO.		
NEW-148198		
JOB/REQ. NO.		
SHIPPING NO.	DATE	
619734	09/29/2000	
CARRIER		
UNION PACIFIC		
CARTRUCK NO.		
CW6090		

THIS MATERIAL HAS BEEN MANUFACTURED, TESTED AND FOUND TO MEET THE SPECIFICATIONS AND PURCHASE ORDER REQUIREMENTS
OSM ALLOY STRUCTURAL QUALITY PLATE ASTM A514-94A GR B.

PHYSICAL PROPERTIES

Q&A	DESCRIPTION	HEAT NO.	SLAB	YIELD PSI X 100	TENSILE PSI X 100	% ELONG 8" 2"	% RA	HARDNESS BHN	BEND TEST	IMPACTS
1	0.5000 X 96.000 X 360.000 THE FOLLOWING PLATES WERE AUSTENITIZED AT 1680 DEGS F FOR 20 MINUTES AND WATER THEN TEMPERED AT 1260 DEGS F FOR 27 MINUTES AND AIR COOLED 1 PC 4901 LBS 00J3598 + 106347 E1 1090 1190 29 55									QUENCHED
	THE FOLLOWING PLATES WERE AUSTENITIZED AT 1680 DEGS F FOR 20 MINUTES AND WATER THEN TEMPERED AT 1260 DEGS F FOR 26 MINUTES AND AIR COOLED 1 PC 4901 LBS 00J3605 + 106354 A1 1130 1220 30 55 1 PC 4901 LBS 00J3606 + 106354 A1 1130 1220 30 53									QUENCHED
	THE FOLLOWING PLATES WERE AUSTENITIZED AT 1680 DEGS F FOR 20 MINUTES AND WATER THEN TEMPERED AT 1260 DEGS F FOR 25 MINUTES AND AIR COOLED 1 PC 4901 LBS 00J3607 + 106354 A1 1130 1220 32 56									QUENCHED

CHEMICAL ANALYSIS

HEAT NO.	C	Mn	P	S	Si	Cu	Ni	V	Cr	Mo	Ti	B	Nb	Ca	CE
+106347	.18	.95	.006	.002	.32	.23	.08	.032	.030	.52	.21	.030	.0025	.0127	
+106354	.20	.95	.005	.002	.32	.22	.08	.031	.029	.54	.22	.028	.0025	.0117	
ALL HEATS INDICATED WITH (+) WERE MELTED AND MANUFACTURED IN THE USA.															

Kristine Hunnwork
KRISTINE HUNNWORK
Q.C. RECORDS ADMINISTRATOR

I certify the above to be correct as contained in the records of OREGON STEEL MILLS By

ID: 136950

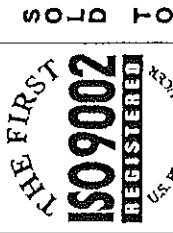
RECEIVED OCT 6 2000

OREGON STEEL MILLS

P.O. BOX 2750, Portland, Oregon 97208 • (503) 286-9651 Fax (503) 240-5268

REPORT OF CHEMICAL/PHYSICAL TESTS

CERTIFICATE NO.	DATE	PAGE
619734	Sep 29, 2000	2
MILL ORDER NO.	DATE	
122965		
CUSTOMER ORDER NO.		
NEW-148198		
JOB/REG. NO.		
SHIPPING NO.	DATE	
619734	09/29/2000	
CARRIER		
UNION PACIFIC		
CAR/TRUCK NO.		
CW6090		



KLOCKNER NAVASCO CORPORATION
ATTN: STEPHANIE CHAMBERS
5775-C GLENRIDGE DRIVE, SUITE 110
ATLANTA, GA 30328

NAVASCO-SOUTHWEST
4501 N MIRO STREET
NEW ORLEANS, LA 70117-4439

THIS MATERIAL HAS BEEN MANUFACTURED, TESTED AND FOUND TO MEET THE SPECIFICATIONS AND PURCHASE ORDER REQUIREMENTS
OSM ALLOY STRUCTURAL QUALITY PLATE ASTM A514-94A GR B.

PHYSICAL PROPERTIES

CSA (EQUIV)	DESCRIPTION	HEAT NO.	SLAB	YIELD PSI X 100	TENSILE PSI X 100	% ELONG 8" 2"	% RA	HARDNESS BHN	BEND TEST	IMPACTS
1	0.5000 X 96.000 X 360.000 THE FOLLOWING PLATES WERE AUSTENITIZED AT 1680 DEGS F FOR 20 MINUTES AND WATER THEN TEMPERED AT 1260 DEGS F FOR 27 MINUTES AND AIR COOLED 1 PC 4901 LBS 00J3610 + 106354 A1			1100	1190	28	47			QUENCHED
	THE FOLLOWING PLATES WERE AUSTENITIZED AT 1680 DEGS F FOR 20 MINUTES AND WATER THEN TEMPERED AT 1260 DEGS F FOR 30 MINUTES AND AIR COOLED 1 PC 4901 LBS 00J3611 + 106354 A1			1100	1190	29	55			QUENCHED
	THE FOLLOWING PLATES WERE AUSTENITIZED AT 1680 DEGS F FOR 21 MINUTES AND WATER THEN TEMPERED AT 1260 DEGS F FOR 34 MINUTES AND AIR COOLED 1 PC 4901 LBS 00J3612 + 106354 A1			1100	1190	30	50			QUENCHED
	THE FOLLOWING PLATES WERE AUSTENITIZED AT 1680 DEGS F FOR 24 MINUTES AND WATER THEN TEMPERED AT 1260 DEGS F FOR 29 MINUTES AND AIR COOLED 1 PC 4901 LBS 00J3613 + 106354 A1			1080	1170	26	46			QUENCHED

CHEMICAL ANALYSIS

HEAT NO.	C	Mn	P	S	Si	Cu	Ni	V	Cr	Mo	Ti	B	Nb	Ca	CE	Welding Spec Qual 550
+106354	.20	.95	.005	.002	.32	.22	.08	.031	.029	.54	.22	.028	.0025	.0117		
ALL HEATS INDICATED WITH (+) WERE MELTED AND MANUFACTURED IN THE USA.																

Kristine Humwork
KRISTINE HUMWORK
O.C. RECEIVING ADMINISTRATOR

I certify the above to be correct as contained in the records of OREGON STEEL MILLS By

ID: 136956

OREGON STEEL MILLS

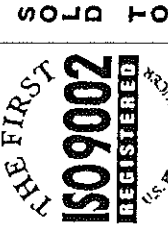
P.O. BOX 2760, Portland, Oregon 97208 • (503) 286-9651 Fax (503) 240-5288

REPORT OF CHEMICAL/PHYSICAL TESTS

CERTIFICATE NO.	DATE	PAGE
619734	Sep 29, 2000	3
MILL ORDER NO.	DATE	
122965		
CUSTOMER ORDER NO.		
NEW-148198		
JOB REQ. NO.		
SHIPPING NO.	DATE	
619734	09/29/2000	
CARRIER		
UNION PACIFIC		
CAR/TRUCK NO.		
CW6090		

KLOCKNER NAMASCO CORPORATION
ATTN: STEPHANIE CHAMBERS
5775-C GLENRIDGE DRIVE, SUITE 110
ATLANTA, GA 30328

NAMASCO-SOUTHWEST
4501 N MIRO STREET
NEW ORLEANS, LA 70117-4439



THIS MATERIAL HAS BEEN MANUFACTURED, TESTED AND FOUND TO MEET THE SPECIFICATIONS AND PURCHASE ORDER REQUIREMENTS
OSM ALLOY STRUCTURAL QUALITY PLATE ASTM A514-94A GR B.

PHYSICAL PROPERTIES

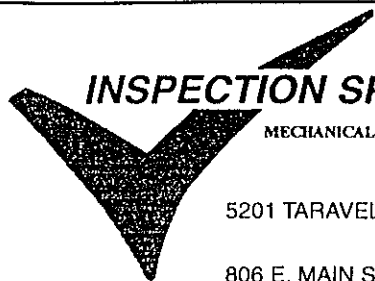
CSA ITEM NO.	DESCRIPTION	HEAT NO.	SLAB	YIELD PSI X 100	TENSILE PSI X 100	% ELONG 8" 2"	% RA	HARDNESS BHN	BEND TEST	IMPACTS
1	0.5000 X 96.000 X 360.000 THE FOLLOWING PLATES WERE AUSTENITIZED AT 1680 DEGS F FOR 20 MINUTES THEN TEMPERED AT 1260 DEGS F FOR 24 MINUTES AND AIR COOLED 1 PC 4901 LBS 00J3620 + 106354 A1			1080	1170	30	53		AND WATER	QUENCHED
2	0.3750 X 96.000 X 360.000 + 106012 THE FOLLOWING PLATES WERE AUSTENITIZED AT 1680 DEGS F FOR 15 MINUTES THEN TEMPERED AT 1270 DEGS F FOR 19 MINUTES AND AIR COOLED 1 PC 3675 LBS 00J0145 + 106012 D2			1110 1120 1120 1120	1200 1210 1210 1210	27 26 28 28	46 51 47 49	276	AND WATER	QUENCHED

CHEMICAL ANALYSIS

HEAT NO.	C	Mn	P	S	Si	Cu	Ni	V	Cr	Al	Mo	Ti	B	Nb	Ca	CE	REMARKS
+106354	.20	.95	.005	.002	.32	.22	.08	.031	.029	.54	.22	.028	.0025	.0117			
+106012	.18	1.00	.004	.004	.30	.27	.10	.038	.034	.54	.21	.033	.0023	.0118			
ALL HEATS INDICATED WITH (+) WERE MELTED AND MANUFACTURED IN THE USA.																	

Kristine Huntwork
KRISTINE HUNTWORK
RECORDS ADMINISTRATOR

I certify the above to be correct as contained in the records of OREGON STEEL MILLS BY _____ Q.C. RECORDS ADMINISTRATOR



INSPECTION SPECIALISTS, INC.

MECHANICAL TESTING LABORATORY DIVISION

5201 TARAVELLA ROAD • MARRERO, LA 70072-4240 • TEL: (504) 347-5600 • FAX: (504) 348-8001

806 E. MAIN STREET UNIT G • BROUSSARD, LA 70518 • TEL: (337) 837-2638 • FAX: (337) 839-2277

CERTIFICATE OF ANALYSIS

Client: Namasco Job No: 3154.90(.1) & (.2)

Client Representative: Lenny Dubroc Purchase Order: 5168819

Test Specification: ASTM A370

Sample Identification: Two (2) -Samples

(.1) = $\frac{3}{8}$ " x 96" x 360" Heat No. 106127

(.2) = $\frac{1}{2}$ " x 96" x 360" Heat No. 106354

The above referenced samples were prepared and tested in accordance with the material requirements of ASTM A370. One (1) set of three (3) charpy v-notch impact test specimens was prepared and tested on each sample. The results of these tests are reported herein.

CHARPY V-NOTCH IMPACT TEST (7.5MM X 10MM X 55MM)

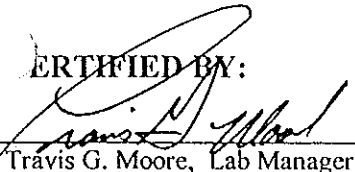
SPECIMEN ID	FOOT POUNDS	LATERAL EXPANSION	PERCENT OF SHEAR
3154.90(.1)-Base 1	98	58	100
3154.90(.1)-Base 2	99	42	100
3154.90(.1)-Base 3	88	44	100
AVERAGE	95.0	48.0	100.0

(10MM X 10MM X 55MM)

3154.90(.2)-Base 1	130	53	100
3154.90(.2)-Base 2	130	55	100
3154.90(.2)-Base 3	112	34	100
AVERAGE	124.0	47.3	100.0

Test Temperature: 0°F

CERTIFIED BY:


Travis G. Moore, Lab Manager

Date: August 28, 2001 Certificate No: 1 of 1



P.O. Box 1900 PASCAGOULA MS 39568-1900

OFFICE: 228-762-2890 FAX: 228-769-5219

CERTIFICATE OF ANALYSIS

HT# 157019

Report No. 272-2F

Page 1 of 1

Date **4/19/02**

Lab No. 272-0402-6

Material A514

Thickness 0.375"

Dia.

HVID No. 907780

Material ■■■■

Thickness

Dia. 6-229

Ht/ID No.

Process

Filler Metal

Position

WPS

Welder

10

From **Delta Steel and Subsidiaries**

PO

Other

Test For Charpy Impact

Test Date 4/19/02

Machine Model & Serial No.

Safec Systems (Baldwin) SI-1-C No. 1444

Calibration Certified By

Nat'l Institute of Stds and Tech.

Date 8/7/01

Specification Followed

ASTM E-23 Figure 1 Type A

Orientation of Specimens

☐ Transverse ☒ Longitudinal

Size 10mm X 7.5mm X 55mm

CHARPY IMPACT TEST RESULTS

Specimen No.	Notch Location	Notch Type	Test Temperature	Impact Values (ft. lbs.)	% Shear	Mill Lateral Exp.	Joules
6 B 1	Base	V	0° F	92			
6 B 2		V	0° F	102			
6 B 3		V	0° F	100			

We certify that the statements in this record are correct and that the test samples were prepared and testing accordance with the requirements of Techweld PMT Procedure No. 1, ASTM E-23.

Test materials will be discarded after thirty (30) days unless prior written notification is received.

Certified By

JOHN C. TAYLOR
84040411
Tadewald, Inc.

Date 4-19-02

BETHLEHEM STEEL CORPORATION
QUALITY and PROCESS TECHNOLOGY
REPORT OF TESTS AND ANALYSES

BETHLEHEM LUKENS PLATE

SHIPMENT NO.

DATE SHIPPED

CAR OR VEHICLE NO.

803-11120

04-25-01

NS-CHGD-UP

MTTX 097524 PAGE 2

AMERICAN ALLOY STEEL INC
900 BOX 40469
HOUSTON TX 77040-0469

ACK 2 2002

AMERICAN ALLOY STEEL, INC
C/O RAMSAY SCARLETT & CO INC
PORT OF GREATER BATON ROUGE
TRACK #791
PORT ALLEN LA 70767

NOTE	SERIAL NUMBER	PAT. NO.	HEAT NUMBER	NO. PCS.	SECTION QUANTITY			WEIGHT	YIELD POINT	TENSILE STRENGTH	ELONG.		RED. %
					THICKNESS	WIDTH OR DIA.	LENGTH				IN	%	
					INCHES	INCHES	INCHES	POUNDS	PSI	PSI			
	PRODUCED UNDER A CERTIFIED QMS COMPLYING WITH ISO 9002 QUALITY STEEL MELTED & MANUFACTURED IN THE U. S. A.												
	PLATES - ABS GR DH36 KLD FINE GRAIN PRAC REV 2001, ABS GR DH36 REV 2001, ASTM A572-00 GR 50, CH-V L 45 F1LR A1 4F EA 50N1 PLT CONTROL ROLL												
	MFST - TEST CERTIFICATES ARE PREPARED IN ACCORDANCE WITH PROCEDURE OUTLINED IN DIN 50049 PARA 3.1B												
	CO# 49103 GH 381-2329												
	OUTSIDE INSPECTION BY AMERICAN BUREAU OF SHIPPING												
			833T67640	2	1.5	120	480	49006	62400 61900	83700 83700	2 2	31 30	
			843P67130	1	1.5	120	480	24503	65200	84600	2	28	

NOTE Q-QUENCH TEMPERATURE

T-TEMPERATURE

N-NORMALIZE TEMPERATURE

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE BY THE BETHLEHEM STEEL CORP. TO THE APPLICABLE SPECIFICATION BY AN APPROVED PROCESS AND HAS BEEN TESTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE AMERICAN BUREAU OF SHIPPING RULES FOR THE INSPECTION AND TESTING OF MATERIALS TO THE SATISFACTION OF THE SURVEYORS.

SATISFACTION OF THE SURVEYORS										CHARPY IMPACT									
SERIAL NUMBER	PAT. NO.	HEAT NUMBER	HARD	BEND	THICKNESS INCHES	TYPE	SIZE	DRL	TEST TEMP. F	ENERGY	FT LBS			SHEAR (K)			LAT. EXP.		MILS
										1	2	3	1	2	3	1	2		
C		833T67640	BHN		1.500	V	FULL		-4	105	152	130							
		843P87730			1.500	V	FULL		-4	133	134	114							
TEST REPORT APPROVED DATE										7-23-01									
AMERICAN ALLOY STEEL BY										Daniel D. J.									
QUALITY ASSURANCE DEPT.																			

HEAT NUMBER	CHEMICAL ANALYSIS															MAGNIFIED GRANT SIZE
	C	Mn	P	S	N	Cr	Mo	Si	Al	Co	W	Fe	As	Se	Other	
833T67640	.13	1.43	.015	.005	.307	.010	.01	.11	.057	.004	.002	.030	.0002	.031	.007	CE
843P67130	.13	1.50	.023	.008	.280	.020	.01	.12	.054	.007	.002	.027	.0002	.033	.007	42
027-23-01 Certified a true copy of the original, retained in our file. AMERICAN ALLOY STEEL, INC.																

I CERTIFY THAT THE ABOVE RESULTS ARE A TRUE AND CORRECT COPY OF ACTUAL RESULTS CONTAINED IN RECORDS MAINTAINED BY BETHLEHEM AND ARE IN FULL COMPLIANCE WITH THE REQUIREMENTS OF THE SPECIFICATION CITED ABOVE. THIS TEST REPORT CANNOT BE ALTERED AND MUST BE TRANSMITTED INTACT WITH ANY SUBSEQUENT THIRD PARTY TEST REPORTS, IF REQUIRED.

SUPERINTENDENT, QUALITY and PROCESS TECHNOLOGY, D. J. FARRELL, PER LDT

CUSTOMER Applied Hydraulic Sys
CUST P.O.# 64780
A.A.S. S/O 202,330
DATE MAILED 7-16-02
DESCRIPTION 71(2) 1/2" X 9/16" X 240"

ORIGINAL FILED
DO NOT REMOVE
DATE 7-16-02
65633




psco steel inc.


12400 Highway 43 North, Lemoynne, AL 36505-4308

Test Certificate

Form TC1: Revision 1: Date 31 Oct 2000


Customer: ONEAL STEEL INC. ONE ONEAL LANE MOBILE, AL 36671		Customer P.O. No.: 77670P188		M/E Order No.: 18-004125-01		Shipping Manifest: 507341							
Product Description: ABS (2001)-DH36/AH36, ASTM A572-50-T2 LCVN 25 FT. LBS. 0-22 DEG. F / A673-H				Ship Date: 17 Feb 02		Cert No: 01585							
Size: 1.000 X 96.00 X 480.0 (IN)													
Tested Pieces		Tensiles		Charpy Impact Tests									
Heat Id	Piece Id	YS (PSI)	UTS (PSI)	Elong % of 2in	Bend Test	Average Hardness	Absorbed Energy 1 2 3 Avg	% Shear 1 2 3 Avg	Test Temp	Test Dir	Test Size		
W1L634 A19	1.001 X 96.37	57000	71000	25			220 236 231 229		-22 F	L	3/4		
Chemical Analysis													
Heat Id	C	Mn	P	S	Si	Tot Al	Cu	Ni	Cr	Mo	V	Ti	CEV
W1L634	.06	1.32	.011	.003	.19	.029	.29	.09	.06	.02	.001	.063	.003 .33

ABS AMERICAS
SURVEYOR
(SIGNED) 
MOBILE, AL - DATE: FEB 28 2002



02M28627 1

100 % MELTED AND MANUFACTURED IN THE USA / DIN 50049 PAR 3.1B COMPLIANCE
W1L634 A19 PIECES: 1, WEIGHT: 13135

(C) Cust Part # : 809133/0436311	WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH THE APPROPRIATE SPECIFICATION
Jim O Rear  Q.A. METALLURGIST	

Test Certificate

THE FIRST TEST

12400 Highway 43 North, Lemoore, AL 36505-4308

QUESTIONS

O'NEAL STEEL INC.
ONE O'NEAL LANE

MOBILE, AL 36671

Customer P.O. No.: 10725780P108

Master Order No.: 13-004244-01

Shipping Manifest : 5467189

Product Description: ASTM A36(DDA)/SA36(98ED)

Ship Date:	08 Mar 82	Cert No:	023753
Count Date:	07 Mar 82		

Sum 0.250 X 96.00 X 240.0 (IN)

Tested Pieces				Tensiles				Charpy Impact Tests									
Heat Id	Piece Id	Piece Dimensions	YS (PSI)	UTS (PSI)	Elong % of 2in	Bend Test	Average Hardness	Absorbed Energy			% Shear			Test Temp	Test Dir	Test Size	
								1	2	3	Avg	1	2	3	Avg		
E2C108	A02	0.250 X 96.39	55000	73000	25												
E2C108	A05	0.250 X 96.44	53000	71000	26												

Chemical Analysis

Heat Id	C	Mn	P	S	Si	Tot Al	Cr	Ni	Mo	Co	V	Ti	CEV
E2C108	.17	.52	.013	.002	.23	.008	.40	.13	.09	.04	.002	.004	.002 .32

100 % MELTED AND MANUFACTURED IN THE USA / DIN 50049 PAR 3.1B COMPLIANCE
 82C108 A06 PIECES: 2, WEIGHT: 3276

*** PRELIMINARY TEST CERTIFICATE - OFFICAL COPY TO FOLLOW **

WE HEREBY CERTIFY THAT THIS MATERIAL
WAS TESTED IN ACCORDANCE WITH THE
APPROPRIATE SPECIFICATION

Cust Part #: 800622/0412001

ISOPROBOL

IPSCO
MATERIAL TEST CERTIFICATE

GREENSPORT INDUSTRIAL PARK, HOUSTON, TX, 77015

CERT DATE: 2/18/02
SHIP DATE: 02/13/02

CUSTOMER:

DELTA STEEL INC
5599 SAN FELIPE
SUITE 600

HOUSTON

TX 77056

CUSTOMER ORDER NO:

IFP-DHO-111532
MATERIAL TYPE & GRADE:
HR CTL 1/4"
ASTM A36-00A/ASME SA36-98
TEMPER LEVELED COIL (TLC)

MILL ORDER NO:

0516762-01
PROCESSOR:
IPSCO TEXAS INC.

SHIPPING TALLY:

0516762-16192
STEEL MANUFACTURER:
IPSCO STEEL, INC.
COUNTRY OF ORIGIN:
USA

HEAT																		
NUMBER	C	MN	P	S	SI	NI	CR	MO	N	CU	AL	TI	V	CB	B	CA		
B2A575	.15	.83	.012	.003	.04	.14	.12	.024	.006	.32	.028	.021	.003	.002	N/A	N/A		
TENSILE TESTS																		
HEAT NUMBER B2A575	MILL COIL NUMBER 0425	PRODUCT										LOC	YS (PSI)	UTS (PSI)	ELONG & OF		BEND TEST	AVG HARDNESS
		DESCRIPTION													2IN	8IN		
		.250 X 96.000 X 240.000																
B2A575	0427	.250 X 96.000 X 240.000										L	64800	74800	21		0	
												C	55600	69800	27		0	
CHARPY V IMPACT TESTS																		
HEAT NUMBER B2A575	MILL COIL NUMBER 0425	ABSORBED ENERGY (FT-LB)						% SHEAR			TEST TEMP (F)	TEST DIR	TEST SIZE					
		1	2	3	AVG	1	2	3										
B2A575	0427										0000			T				
											0000			T				

WE CERTIFY THE HEAT ANALYSIS AND OR TEST RESULTS SHOWN ABOVE ARE TRUE AND EXACT AS CONTAINED IN THE PERMANENT RECORDS OF IPSCO. THESE RECORDS MAY BE EXAMINED BY YOUR PERSONNEL OR ANY AGENT AUTHORIZED BY YOU.

AUTHORIZED AGENT:

Mill Test Report



NUCOR
PLATE MILL

P.O. Box 279
Winton, NC 27986
(252)-356-3700

DEC-24-01

03:33

FROM

Date: 11/12/01 B/L No.: 11928 Load Req. No.: 13196

Our Order No.: 4247-1

Cust. Order No.: NEW-191189

Specification: .750" x 96.000" x 240.000

ASTM A36-00/ASTM A709 Grade 36-00/ASME SA3696

CHARPY V-NOTCH TESTED 15 FT LBS @ 10°F (FREQ H, LONG)

Sold/NAMASCO Corporation Southwest

To: 4501 N. Miro Street

New Orleans, LA 70117

NAMASCO NEW ORLEANS (TRK)

Ship To: 4501 N. Miro Street

New Orleans, LA 70117

Heat No.	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al	V	Nb (Cb)	Ti	N	Ca	B	Sn	Ceq	pcm
1103242	.20	.92	.009	.001	.28	.25	.06	.07	.00	.028	.004	.001							

Plate Serial No.	Tensile Test				Charpy Impacts (ft-lbs)			
	Pieces	Yield (psi)	Tensile (psi)	Elongation (% in 2")	Elongation (% in 8")	Dir.	1	2
1103242-03	8	48,100	75,100	23.4	20.3	L.	111.7	121.7
		40,900	70,200				100.2	100.2
							Ave.	111.2
							Size (mm)	10.0
							Temp (°F)	+10°F
							Min. Av	15

+2523563903

T-034 P.003/003 F-944

Manufactured to a fully killed fine grain practice. Welding or weld repair was not performed on this material. Melted and manufactured in the USA. Yield by .5EUL method.
Mercury has not been used in the direct manufacturing of this material.
Ceq=C+(Mn/5)+((Cr+Mo+V)/5)+((Cu+Ni)/15)
pcm=C+(Si/20)+(Mn/20)+(Ni/60)+(Cr/20)+(Mo/15)+(V/10)+5B

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications.

T. A. Depretis
T. A. Depretis, Metallurgist

Test Certificate



ipscor steel inc.

1770 Bill Sharp Boulevard, Muscatine, IA 52761-9412

Customer: NAMASCO - SOUTHWEST 4501 N MIRO ST NEW ORLEANS, LA 70117		Customer P.O. No.: NEW-160493		MGB Order No.: 93-820488-01		Shipping Manifest : 150107							
Product Description: A36/A799-97B GR36/SA-36(98ED)													
Ship Date: 22 Jan 01 Cert Date: 22 Jan 01 Cert No: 102971													
Size: 0.375 X 96.00 X 240.0 (IN)													
Tested Pieces				Charpy Impact Tests									
Heat Id	Piece Id	Piece Dimensions	Tensiles			Charpy Impact Tests							
			YS (PSI)	UTS (PSI)	Elong % of 2in 8in	Average Hardness	Absorbed Energy 1 2 3 Avg	% Shear 1 2 3 Avg	Test Temp	Test Dir	Test Size	BDWTT	
B01559	F02-A	0.380 X 100.4	49000	62000	44								
Chemical Analysis													
Heat Id	C	Mn	P	S	Si	Total	Cr	Ni	Cu	V	Ti	Al	GrV
B01559	.07	.97	.007	.006	.29	.021	.08	.14	.27	.012	.004	.021	.29

100 % MELTED AND MANUFACTURED IN THE USA / DIN 50049 PAR 3.1B COMPLIANCE
B01559 F02 -A PIECES: 2, WEIGHT: 5173
CERTIFIED TO ASTM A36-94 / ASME SA-36 E95 / ASTM A709-95A GR 36

Cust Part # :	WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH THE APPROPRIATE SPECIFICATION	P. A. CROZIER
		Q.A. METALLURGIST

GB 2008 4PT 18-00

67-J458-01

Gulf States Steel, Inc.

GADSDEN, AL 36004-1026

GSS ORDER NO. NUMBER ITEM MFG		PURCHASE ORDER DATE	
G	50812 04 742	06 10 97	
PURCHASE ORDER NO.		SHIPPED FROM	
NEW 61187		ALA CITY	

CERTIFICATE
OF TESTS

ACCOUNT NUMBER 71390006	PAGE NO. 2	INVOICE NUMBER 742-70925
DATE SHIPPED 07 22 97	ROUTE/VEHICLE IDENTIFICATION MS 101529	

I HEREBY CERTIFY THAT THE MATERIAL LISTED HEREIN HAS BEEN INSPECTED AND TESTED IN ACCORDANCE WITH THE METHODS PRESCRIBED IN THE GOVERNING SPECIFICATIONS AND BASED UPON THE RESULTS OF SUCH INSPECTION AND TESTING HAS BEEN APPROVED FOR CONFORMANCE TO THE SPECIFICATIONS.

C. F. BEARDEN, JR.
MGR. TECHNOLOGY AND
QUALITY - PLATE PRODUCTS

(PRINT TO SAME AS "SOLD TO" UNLESS OTHERWISE INDICATED)

KLOCKNER KAMASCO CORP
SOUTHWEST DIVISION
P O DRAWER 450469

HOUSTON TX 77245-0469

KLOCKNER KAMASCO CORP
SOUTHWEST DIV
4501 N MIRD STREET

NEW ORLEANS LA 70117 0469

MATERIAL DESCRIPTION

PLATE CARBON ASTM A-36-94 ASME SA-36 DTD 07/01/95 SUPP S-91 KILLED FINE GRAIN
PRACTICE IMPACT TEST HEAT QUAL MELTED & MFG IN USA

QUANTITY SHIPPED

1.2500 X .96 0000 GAS CUT EDGE X 240.0000 IN
HT 7454179 2 PCS
HT 7454508 1 PCS

24509

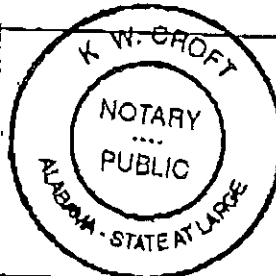
CH C 25MX MM 00/1.20 P 040MX S 050MX SI 15/40 CU RPT NI RPT CR RPT NO RPT CB RPT U RPT AL
020NIM

MR YLD 36000 MIN TEN 58/80000 XELONG MIN 2 IN 23 OR 8 IN 20 IMP HT QUAL LT MR 15 FT LBS AUG 10
FT LBS MIN AT PLUS 10 DEG F

TI 3 NOTW TR CA

STATE OF ALABAMA COUNTY OF ETOHAN
WORN AND SUBSCRIBED TO BEFORE ME
THIS 23 DAY OF JULY 1997

Notary Public



HEAT NUMBER	DRAM	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Cb	V	Al	N	B	Ca	Ti	CE
7454179		.21	1.11	.010	.013	.210	0.03	0.01	0.02	.03	.003	.001	.042					
7454508		.22	1.30	.014	.015	.248	0.03	0.01	0.02	.02	.003	.002	.047					
HEAT NUMBER	TEST OR PIECE IDENTITY NO.	YIELD KSI	TENSILE KSI	% ELONG		HARDNESS	BEND TEST	HEAT TREAT	Y&TS RATIO	% RED. AREA	GALV COATING	DROP WEIGHT TESTS						
				P"	B"							DIR	TEMP °F	1	2	AVG		
7454179	8821901	49.0	74.0					RR	.66									
7454508	U842001	53.0	80.0			28		RR	.66									
7454508	U842501	52.0	78.0			26		RR	.66									
						29		RR										
HEAT NUMBER	TEST OR PIECE IDENTITY NO.	HEAT TREAT	SIZE	DIR	TEMP °F	ENERGY				% SHEAR				MILS LATERAL EXPANSION				
						1	2	3	AVG	1	2	3	AVG	1	2	3	AVG	
7454179	8821901	RR	FUL	LT	10	60	65	62	62									
7454508	U842501	RR	FUL	LT	10	45	50	50	48									

CONTINUED

8707228080414

CONTINUED

870722080414

B/LH 209048

00000
DELTA STEEL, INC.
7355 ROUNDHOUSE

NUCOR STEEL
A Division of NUCOR Corporation
JEVETT, TEXAS 75846 PH (903) 626-4461
CERTIFIED MILL TEST REPORT

43025
DELTA STEEL
7355 ROUNDHOUSE LANE

HOUSTON	TX	77078	HEAT #	SIZE	GRADE	C	Mn	Si	S	P	V	Nb	Cu	Cr	Ni	Mo	TX	Bend Test
2 x 2 x 1/4			315-4170	Tensile	78400	.185	.952	.331	.046	.017	.006	.025	.678	.202	.172	.048	.015	
ASTM A36-00A/A529-00	GR 50			Yield	54000													
POH - DH0-111504				Elong%	24													
3 x 2 1/2 x 1/4			305-3365	Tensile	66000	.142	.692	.188	.033	.014	.006	.006	.358	.133	.142	.033	.011	
A36-00A/A709-00A/SA36-98				Yield	46200													
POH - DH0-111504				Elong%	25													
2 1/2 x 2 1/2 x 1/4			315-4335	Tensile	72000	.148	.697	.204	.032	.008	.003	.013	.326	.107	.109	.035	.015	
ASTM A36-00A/A529-00	GR 50			Yield	50200													
POH - DH0-111504				Elong%	24													
3 1/2 x 3 1/2 x 1/4			315-4360	Tensile	72700	.160	.769	.205	.032	.009	.004	.015	.510	.163	.184	.050	.010	
ASTM A36-00A/A529-00	GR 50			Yield	50500													
POH - DH0-111504				Elong%	24													
3 x 2 x 5/16			314-3645	Tensile	70800	.137	.687	.216	.036	.008	.002	.011	.418	.093	.107	.035	.014	
A36-00A/A709-00A/SA36-98				Yield	46300													
POH - DH0-111504				Elong%	23													
6 x 6 x 1			314-2531	Tensile	74000	.204	.818	.202	.030	.016	.005	.023	.292	.197	.208	.056	.011	
ASTM A572-00	GR50			Yield	53800													
POH - DH0-111504				Elong%	18													

Ben R. Cave

ALL MATERIAL STRAND CAST

ELONGATION IN 8 INCH SCALE
MELTED AND MANUFACTURED IN U.S.A.

CHIEF METALLURGIST
Ben Cave
BY CARMELA

Steel Certificate of Test

TIMKEN

WORLDWIDE LEADER IN BEARINGS AND STEEL

1835 DUEBER AVE. S.W.
CANTON, OHIO 44706

Page 1 of 2

11/27/2001

ID #0013716-1

S Marmon/Keystone Corporation
O T 105 GOODRICH DR
L O
D TARRANT AL 35217 USA

S Marmon/Keystone Corporation
H T 105 GOODRICH DR
I O
P TARRANT AL 35217 USA

Customer Order: 10-23530-055 YEI SE TRANSFER Customer Part Number: 8-51.5130
Timken Order: 51752-A (1075376) Heat Number(s): W0235

Description of Material

OD: 8.500 in (215.900 mm) WALL: 1.500 in (38.100 mm) ID: 5.500 in (139.700 mm)
Shape: RD
Sales Type: 1026
Int Quality: ELECTRIC FURNACE-ULTRASONIC
Condition: HOT ROLL

Specification

- ASTM A 106 Rev. 99 GRADES B & C EXCEPT WEIGHING OF INDIVIDUAL TUBES
- ASME SA-106 Rev. 1998 EDITION 01/01/1998 GRADES B & C EXCEPT WEIGHING OF INDIVIDUAL TUBES
- ASTM E 213 Rev. 98 01/01/2001 FOR NONDESTRUCTIVE ELECTRIC TESTING
- ASTM A 519 Rev. 96
- NACE MR0175 Rev. 97 01/01/1997

Chemistry Information

	%C	%Mn	%P	%S	%Si	%Cr	%Ni	%Mo	%Cu	%Al	%V
SPEC Ladle Min:	.22	.60			.10						
SPEC Ladle Max:	.28	.90	.025	.025		.40	.40	.15	.40		.080
W0235 Ladle:	.26	.83	.007	.020	.26	.06	.08	.03	.24	.029	.001

When shipping document is attached it becomes part of this certification.

We certify the above materials have been inspected and tested in accordance with the methods prescribed in the governing specifications, and the results of such inspections and tests conform with the applicable requirements. This certificate or report shall not be reproduced except in full, without the written approval of the Timken Corporation.

Approved: _____

NOTARY PUBLIC

by

Essie Dillard, CERTIFICATION PROCESSOR

THE TIMKEN CORPORATION

Q. C. REVIEWED	
DATE	INITIAL
12/11/01	BT

T
8.51.5 TL
W0235
130

Steel Certificate of Test

TIMKEN

1835 DUEBER AVE. S.W.
CANTON, OHIO 44706

Page 2 of 2

WORLDWIDE LEADER IN BEARINGS AND STEEL

11/27/2001

ID #0013716-1

Customer Order: 10-23530-055 YEI SE TRANSFER Customer Part Number: 8.51.5130
Timken Order: 51752-A (1075376) Heat Number(s): W0235

Metallurgy Information

SPEC: Hardness MIDWALL 22 Max UOM ROCKWELL C

Heat	Piece#				UOM
W0235	A	MIDWALL	87.0 / 88.0	ROCKWELL	B

SPEC: Tensile MIN ELONGATION 22 Min STRENGTH UOM PSI TENSILE 70,000.00 Min YIELD .2
40,000.00 Min

Heat	Piece#	Tensile Strength	UOM	.2% Yld Strength	Elong %	%Red	Gauge Length	Specimen	Direction
W0235	A	78,230	PSI	56,620	27.4	57.0	2 IN	.505" RD	LONG.

Ultrasonic in lieu of hydrostatic testing - Satisfactory.
Flattening test - Satisfactory

THE TIMKEN CORPORATION

TIMKEN

WORLDWIDE LEADER IN BEARINGS AND STEEL

STEEL

CERTIFICATE OF TEST

1835 DUEBER AVE. S.W.

CANTON, OHIO 44706

OCTOBER 26, 1999

SOLD TO: MARMON/KEYSTONE CORPORATION
BOX 791
BUTLER PA 16003 USA

SHIP TO: MARMON/KEYSTONE CORPORATION
132 VALVOLINE DRIVE
EAST BUTLER PA 16029 USA

DESCRIPTION ELECTRIC FURNACE 1026 - HOT ROLLED - SCALE FREE
OF MATERIAL: SPEC: SEE GENERAL STATEMENTS FOR SPECIFICATIONS

TIMKEN ORDER 40002 RELEASE A CUSTOMER ORDER 80-45386-003 SPP
SIZE OD 3.500" WALL .500" ID 2.500"

HEAT	C	MN	P	CHEMICAL ANALYSIS						PIECE NO.	CV NO.
				S	SI	CR	NI	MO	CU		
J7469 LADLE	.27	.86	.010	.024	.27	.11	.12	.03	.23		

HEAT	AL	V	CB	PIECE NO.	CV NO.
J7469 LADLE	.027	.001	.001		

BRINELL HARDNESS

HEAT	PIECE NO.	RANGE
J7469		194.0/194.0

LONGITUDINAL TENSILE TEST

HEAT	PIECE NO.	.20% YIELD STRENGTH		TENSILE STRENGTH		ELONG %		TEMP C	SPECIMEN
		P.S.I.	P.S.I.	IN	%	RED			
J7469		66,529	87,190	2.0	24.1	60.0			.505" ROUND

WHEN SHIPPING NOTICE IS ATTACHED IT BECOMES PART OF THIS CERTIFICATION

WE CERTIFY THE ABOVE MATERIALS HAVE BEEN INSPECTED AND TESTED
IN ACCORDANCE WITH THE METHODS PRESCRIBED IN THE GOVERNING
SPECIFICATIONS, AND THE RESULTS OF SUCH INSPECTIONS AND TESTS
CONFORM WITH THE APPLICABLE REQUIREMENTS.

APPROVED BY: JEPSON

NOTARY PUBLIC

Jeff Jenson
Supervisor-Met. Order Processing

THE TIMKEN CORPORATION

999-9467-0199

TIMKEN

WORLDWIDE LEADER IN BEARINGS AND STEEL

STEEL

CERTIFICATE OF TEST

1835 DUEBER AVE. S.W.

CANTON, OHIO 44706

SEPTEMBER 02, 1999

SOLD TO: MARMON/KEYSTONE CORPORATION
4250 BLUE RIDGE INDUSTRIAL PARKWAY
NORCROSS GA 30071 USA

SHIP TO: MARMON/KEYSTONE CORPORATION
4250 BLUE RIDGE INDUSTRIAL PARKWAY
NORCROSS GA 30071 USA

DESCRIPTION ELECTRIC FURNACE 1026 - HOT ROLLED - SCALE FREE
OF MATERIAL: SPEC: SEE GENERAL STATEMENTS FOR SPECIFICATIONS

TIMKEN ORDER 39427 RELEASE A CUSTOMER ORDER 20-41478-002 SPP
SIZE OD 5.500" WALL .750" ID 4.000"

HEAT	CHEMICAL ANALYSIS									PIECE NO.	CV NO.
	C	MN	P	S	SI	CR	NI	MO	CU		
J7679 LADLE	.27	.87	.009	.020	.26	.09	.12	.03	.21		

HEAT	AL	V	CB	PIECE NO.	CV NO.
J7679 LADLE	.029	.001	.001		

BRINELL HARDNESS

HEAT	PIECE NO.	RANGE
J7679		192.0/197.0

LONGITUDINAL TENSILE TEST

HEAT	PIECE NO.	.20% YIELD STRENGTH		TENSILE STRENGTH		ELONG IN 2"		TEMP C	SPECIMEN
		P.S.I.	P.S.I.	P.S.I.	P.S.I.	%	%		
J7679		62,810	86,120	2.0	25.4	55.0			.505" ROUND

WHEN SHIPPING NOTICE IS ATTACHED IT BECOMES PART OF THIS CERTIFICATION

WE CERTIFY THE ABOVE MATERIALS HAVE BEEN INSPECTED AND TESTED
IN ACCORDANCE WITH THE METHODS PRESCRIBED IN THE GOVERNING
SPECIFICATIONS, AND THE RESULTS OF SUCH INSPECTIONS AND TESTS
CONFORM WITH THE APPLICABLE REQUIREMENTS.

APPROVED BY: JEPSON

NOTARY PUBLIC

BY Jeff Jepson
Supervisor-Met. Order Processing

THE TIMKEN CORPORATION

999-9467-0199

STEEL

1635 DUEBER AVE. S.W.

CERTIFICATE OF TEST

CANTON, OHIO 44706

TIMKEN

WORLDWIDE LEADER IN BEARINGS AND S

TIMKEN ORDER 39427 RELEASE A CUSTOMER ORDER 20-41478-002

SEPTEMBER 02, 1999
SPP

LONGITUDINAL TENSILE TEST

PIECE NO.	.20% YIELD STRENGTH	TENSILE STRENGTH	ELONG		RED TEMP	C	SPECIMEN
	P.S.I.	P.S.I.	IN	%			
	72,416	87,870	2.0	23.4	59.0		.505" ROUND

HEAT J7679 - SPEC: ASTM-A106-97A GRADES B & C EXCEPT WEIGHING OF INDIVIDUAL
TUBES & EXCEPT TOLERANCES, ASME-SA106 (1998 EDITION) GRADES B &
C EXCEPT WEIGHING OF INDIVIDUAL TUBES & EXCEPT TOLERANCES OF
1998/01/01, ASTM-A519-96, NACE MR0175-97 OF 1997/01/01

ASTM-E213-93 FOR NONDESTRUCTIVE ELECTRIC TESTING - SATISFACTORY

ULTRASONIC IN LIEU OF HYDROSTATIC TESTING - SATISFACTORY

FLATTENING TEST - SATISFACTORY



**LTV
COPPERWELD**

TUBULAR PRODUCTS



LTV COPPERWELD
MECHANICAL GROUP SHELBY
SHELBY, OHIO 44875-1471
Telephone 419/342-1200 FAX: 419/342-1437

MATERIAL TEST REPORT

QS9000/ISO 9002 CERTIFIED

SHELBY ORDER NO.
153743

C U S T O M E R	MARMON KEYSTONE CORPORATION 2505 FIRST AVENUE SOUTH IRONDALE AL 35210 ATTN: TEST REPORTS DEPT.		SPECIFICATION ASTM A513 98	CUSTOMER ORDER 10-019504
--------------------------------------	---	--	-------------------------------	-----------------------------

GRADE 1026	SIZE(O.D x ID x WALL) 4.000 X 3.000 X .500	QUANTITY 10862 LB	581.26 FT	SHIPPED 07/20/01	DATE 07/20/01
---------------	---	----------------------	-----------	---------------------	------------------

CONDITION EW DOM STRESS RELIEVE ANNEAL			PART NO. 4..5210	S# 00104401 50000143
---	--	--	---------------------	-------------------------

HEAT NO.	CHEMICAL ANALYSIS											GRAIN SIZE
	C	Mn	P	S	Si	Ni	Cr	Mo	Cu	V	Al	
0944399	.25	.66	.011	.003	.030	.010	.030	.010	.020	.003	.044	CA .0031 TI .0020 N .0054

MECHANICAL PROPERTIES									MAGNAFLUX	
HEAT NO.	LOAD NO.	YIELD PSI	TENSILE PSI	ELONG %	RED AREA %	HARDNESS		IMPACT FT.-LBS	FREQ.	SEVERITY
						BHN	ROCKWELL			
0944399	T2793751	83500	93900	2.0" 19			RB 94			

JOMINY HARDENABILITY (EXPRESSED IN 16THS)																
HEAT NO.	1	2	3	4	5	6	7	8	10	12	14	16	20	24	28	32

J-K RATING				SLAG-OXIDE RATING			
HEAT NO.	A	B	C	D	INGOT	OXIDE	SLAG

Q. C. REVIEWED
DATE 7/23/01
INITIAL BT

MELT SOURCE	SBS	THIS TEST REPORT NOTARIZED WHEN REQUIRED SWORN AND SUBSCRIBED BEFORE ME THIS _____ DAY OF _____
OTHER INSPECTION MANUFACTURED IN THE USA		

NOTARY PUBLIC

Brian M. Clark
Brian M. Clark, Chief Metallurgist

MATERIAL PRODUCED TO THE SPECIFICATION(S) SHOWN ABOVE. NO ADDITIONAL SPECIFICATION(S) IS IMPLIED OR WARRANTED. THIS TEST REPORT SHALL NOT BE ALTERED OR REPRODUCED EXCEPT IN FULL.

T 4.5 05 0944399 810



BAYOU STEEL CORPORATION
(TENNESSEE)

2404 S. ROANE STREET
HARRIMAN, TENNESSEE 37748
Telephone (865) 882-5100

MATERIAL CERTIFICATION REPORT

O'NEAL STEEL INC.
P.O. BOX 98
BIRMINGHAM, AL 35201-0098

O'NEAL STEEL, INC.
1044 O'NEAL DRIVE
HIGHWAY 94
BREAUX BRIDGE, LA 70517
PO:0619584 03 11
Prod Id:0350001

TESTED IN ACCORDANCE WITH

INVOICE NO.

PRODUCT FLATS

HEAT NO. 98886

Length 20'0"

DATE 01/30/02

Cust O-3300 -0013

GRADE A3644W

SIZE F 3 X 3/8 X 3.830

CHEMICAL ANALYSIS	
C	.15
Mn	.80
P	.021
S	.02
Si	.21
Cu	.29
Ni	.22
Cr	.21
Mo	.047
Cb	.000
V	.000
B	
Al	

MECHANICAL PROPERTIES		
TEST 1	TEST 2	TEST 3
YIELD STRENGTH - PSI	50,500	50,100
TENSILE STRENGTH - PSI	72,700	72,700
ELONGATION %	26.0	26.0
BEND TEST	8	8
GUAGE LENGTH		
DIAMETER		
RESULTS		
SPECIMEN AREA - SQ. IN.		
REDUCTION OF AREA %		
IMPACT STRENGTH FT/LBS.		

INTERNAL CLEANLINESS	SEVERITY	FREQUENCY	RATING
----------------------	----------	-----------	--------

Customer Grade & Specs: ASME SA36
"NO WELD REPAIR" A709 GR. 36

HARDENABILITY	
JOMINY TEST RESULTS	
GRAIN SIZE	
ROCKWELL C HARDNESS	
DISTANCE FROM	
QUENCHED END IN	
1/16th INCH INCREMENTS	
1	13
2	14
3	15
4	16
5	18
6	20
7	22
8	24
9	26
10	28
11	30
12	32

I HEREBY CERTIFY THAT THE MATERIAL TEST RESULTS PRESENTED HERE ARE FROM THE REPORTED HEAT AND ARE CORRECT. ALL TESTS WERE PERFORMED IN ACCORDANCE TO THE SPECIFICATIONS REPORTED ABOVE. ALL STEEL IS ELECTRIC FURNACE MELTED, MANUFACTURED, AND TESTED IN THE U.S.A WITH SATISFACTORY RESULTS, AND IS FREE OF MERCURY CONTAMINATION IN THE PROCESS.

SIGNED Robert L. Mowman

ROBERT L. MOWMAN, QUALITY ASSURANCE MANAGER

NOTARIZED UPON REQUEST:

SWORN TO AND SUBSCRIBED BEFORE ME ON _____ DAY OF _____, 20____

IN ROANE COUNTY, TENNESSEE BY _____

COMMISSION EXPIRATION: _____

DIRECT ANY QUESTIONS OR NECESSARY CLARIFICATIONS CONCERNING THIS REPORT TO THE SALES DEPARTMENT.



GLOBAL X-RAY & TESTING CORPORATION

Post Office Box 1536
Morgan City, Louisiana 70381

JOEL MOREAU, President
Residence: 504-446-8861

MT WORK REPORT

Bus: 504-631-2426
Fax: 504-631-0093

Report No. M 10578

10-58-391

CLIENT Applied Hydraulics DATE 5-22-07
CONTRACTOR Same JOB LOCATION Houma, LA.
JOB NO. _____ REMARKS MT Insp.
WO NO. 020209 AFE NO. _____ PO NO. _____
MT TECH Mitchell Holant LEVEL II CLIENT REPRESENTATIVE [Signature]

WELD LOCATION AND IDENTIFICATION SKETCH

MT Insp. of Crane Boom

Quantity: _____		Total Accepted: _____				Total Rejected: _____		
	Weld Identification	Area Examined		Interpretation		Repairs		Remarks
		Entire	Specific	Accept.	Reject	Accept.	Reject	
1								
2	MT Insp. of Repair on long seam of Crane Boom "Preliminary"							
3								
4				✓				
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

PRE-EXAMINATION

Surface Preparation: Good

EQUIPMENT

Instrument Make: Parker Model: 13-300 S. No.: 7000

METHOD OF INSPECTION

☐ Dry ☒ Wet ☐ Visible ☐ Fluorescent

How Media Applied: Spray

☐ Residual ☒ Continuous ☐ True-Continuous

☒ AC ☐ DC ☒ Half-Wave

☐ Prods ☐ Yoke ☐ Cable Wrap ☐ Other _____

Direction for Field:

☐ Circular

☐ Longitudinal

Cleaning (if required):

Marking Method:

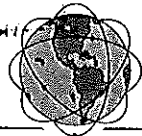
We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared and tested in accordance with the requirements of AWS D11 Sec. 6.10 GXT-MPUM-001-REV.10

Travel Time _____

Mileage _____

Subsistence _____

Hours Worked 1hr



GLOBAL X-RAY & TESTING CORPORATION

Post Office Box 1536
Morgan City, Louisiana 70381

JOEL MOREAU, President
Residence: 504-446-6861

MT WORK REPORT

Bus: 504-631-2426
Fax: 504-631-0093

Report No. M 10601

CLIENT Applied Hydraulics DATE 5-23-02
CONTRACTOR Same JOB LOCATION Houma, LA.
JOB NO. _____ REMARKS MT Insp.
WO NO. 020209 AFE NO. _____ PO NO. _____
MT TECH Mitchell Helbert LEVEL II CLIENT REPRESENTATIVE [Signature]

WELD LOCATION AND IDENTIFICATION SKETCH

MT Insp. of Crane Boom

Quantity:	Total Accepted:				Total Rejected:			
	Weld Identification	Area Examined		Interpretation		Repairs		Remarks
		Entire	Specific	Accept.	Reject	Accept.	Reject	
1								
2	MT INSP. of Repair on long seam on Crane Boom "Final" after 48 hrs							
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

PRE-EXAMINATION

Surface Preparation: Good

EQUIPMENT

Instrument Make: Parker Model: B-300 S. No.: 7000

METHOD OF INSPECTION

☐ Dry ☒ Wet ☐ Visible ☐ Fluorescent

How Media Applied: Spray

☐ Residual ☒ Continuous ☐ True-Continuous

☒ AC ☐ DC ☐ Half-Wave

☐ Prods ☐ Yoke ☐ Cable Wrap ☐ Other _____

Direction for Field:

Cleaning (if required):

☐ Circular

☐ Longitudinal

Marking Method: _____

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared and tested in accordance with the requirements of ASME Div. Sec. 6, 10, 6XT-MPW-01-001-Rev. 10

Travel Time _____

Mileage _____

Subsistence _____

Hours Worked 1hr

GLOBAL X-RAY & TESTING CORPORATION

JOEL MOREAU, President
Residence: 504-446-6861

Post Office Box 1536
Morgan City, Louisiana 70381

Bus: 504-631-2426
Fax: 504-631-0093

MT WORK REPORT

Report No. M
1178

D# 58391

CLIENT Applied Hydraulics DATE 5/20/02
CONTRACTOR Premier JOB LOCATION Harvey, LA
JOB NO. W0# 020209 CLIENT REPRESENTATIVE [Signature]
MT TECH. Tommy Plaisance REMARKS MT Inspection

	WELD NO.	WALL THICKNESS	RECOMMENDATIONS				WELD NO.	WALL THICKNESS	RECOMMENDATIONS		
			✓	✗	REMARKS				✓	✗	REMARKS
1						51					
2						52					
3						53					
4						54					
5						55					
6						56					
7						57					
8						58					
9						59					
10						60					
11						61					
12						62					
13						63					
14						64					
15						65					
16						66					
17						67					
18						68					
19						69					
20						70					
21						71					
22						72					
23						73					
24						74					
25						75					
26						76					
27						77					
28						78					
29						79					
30						80					
31											
32											
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40											
41											
42											
43											
44											
45											
46											
47											
48											
49											
50											

SURFACE CONDITION
 GOOD (✓) FAIR () PAINTED () WELD ()
 MAKE ERRORS EQUIPMENT
 MODEL None MODEL ESP S/N 5045
CONTRACTS
 PROD SPACING 3 to 5" CONTINUOUS ()
 AC (✓) DC () HALF WAVE () FULL WAVE ()
 AMPS _____
MEDIA
 7C-BLACK WET () 8A-DRY () WHITE HIGHLIGHT (✓)
CALIBRATION 2cm
 10# WEIGHT LIFT () FLUX IND. CHECK ()
 CALIBRATION DATE: _____
ACCEPTANCE CRITERIA
AWS D1.1 Sec 6
 TOTAL TIME HRS. 2hrs



GLOBAL X-RAY & TESTING CORPORATION

Post Office Box 1536
Morgan City, Louisiana 70381

JOEL MOREAU, President
Residence: 504-446-6861

Bus: 504-631-2426
Fax: 504-631-0093

UT WORK REPORT

BT—BURN THROUGH
BTA—BURN THROUGH AREA
C—CRACK
IU—INTERNAL UNDERCUT

TERMS AND ABBREVIATIONS
LC—LOW CROWN
LP—LACK OF PENETRATION
NF—NON FUSION
NW—NARROW WELD

OU—OUTSIDE UNDERCUT
P—POROSITY
SI—SLAG INCLUSIONS
SL—SLAG LINES

8376

CLIENT Applied Hydraulics

DATE 5/20/02

CONTRACTOR Premier

JOB LOCATION Harvey, La.

JOB NO. WOK 020209

CLIENT'S REPRESENTATIVE Phillip S. Smith

UT TECH. Tommy Plaisance

REMARKS UT Inspection

WELD NO.	WALL THICKNESS	RECOMMENDATION		REMARKS	WELD NO.	WALL THICKNESS	RECOMMENDATION		REMARKS
		✓	✗				✓	✗	
1					51				
2					52				
3					53				
4					54				
5					55				
6					56				
7					57				
8					58				
9					59				
10					60				
11					61				
12					62				
13					63				
14					64				
15					65				
16					66				
17					67				
18					68				
19					69				
20					70				
21					71				
22					72				
23					73				
24					74				
25					75				
26					76				
27					77				
28					78				
29					79				
30					80				
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43									
44									
45									
46									
47									
48									
49									
50									

EQUIPMENT

KRAUT KRAMER USK 7
TRANSDUCER (M H Z) 2.25 x 600
ANGLE USED 70
REFERENCE STANDARD AWS D1.1 sec 6


CALIBRATION

db Gain 8dB Sweep Delay 80
Zero Delay 80 Reference Level 80

SUBSTANCES

AUTO TRANSPORTATION MILES 1/12
WATER TRAVEL TIME HRS. 1/12
LAND TRAVEL TIME HRS. 1/12
WORK TIME HRS. 1/12
STANDBY TIME HRS. 1/12
TOTAL TIME HRS. 1/12

Material Traceability Log

CRANE WO. NO.:	020209
CUSTOMER:	S.W. PETROLEUM SERVICES/ PEMEX
WELDMENT PART NO.:	N61984-016
WELDMENT S/N:	N/A
DESCRIPTION:	Hoist Weldment (Main)
MODEL:	180B-60
CHECKED BY:	
DATE:	6-12-02

[illegible]

To: Kusty

NUCOR
P.O. Box 279
Winton, NC 27986
(252) 356-3700

Mill Test Report

Page 1



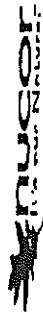
Issuing Date: 11/12/2001 BL No.: 11884 Load No.: 13427 Our Order No.: 4215/1 Cust. Order No.: 1060949 ✓
Specification: .5" x 96" x 240" ✓ Sold To: ONEAL STEEL INC Ship To: ONEAL STEEL GREENSBORO
ASTM A36-00/ASTM A709 Grade 36-00/ASME SA36-96 P O BOX 98 301 STANDARD DRIVE
Marking: 0426001 ✓ 805829 BIRMINGHAM, AL 35201 GREENSBORO, NC 27409
Test Result Note:

Heat No.	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al	V	Nb (Cb)	Ti	N	Ca	B	Sn	Ceq	pcm
1103257	0.16	0.95	0.011	0.004	0.13	0.25	0.07	0.08	0.01	0.072	0.003	0.001	0.005	0.0000	0.0020		0.011	0.358	0.218
Tensile Test										Charpy Impacts (ft-lbs)									
Plate Serial No	Pieces	Yield (psi)	Tensile (psi)	Elongation (% in 2")	Elongation (% in 8")	Dir.		1	% shear	2	% shear	3	% shear	Ave.	% shear	Size	Temp.	Min Ave	
1103257-01	3	44,900	68,900		24.2														
		47,100	70,300		24.3														

Manufactured to fully killed fine grain practice. Welding or weld repair was not performed on this material. Melting and manufactured in the USA. Yield by 0.5EUL method.
Mercury has not been used in the direct manufacturing of this material.
 $Ceq = C + (Mn / 6) + ((Cr + Mo + V) / 5) + ((Cu + Ni) / 15)$
 $Pcm = C + (Si / 30) + (Mn / 20) + (Cu / 20) + (Ni / 60) + (Cr / 20) + (Mo / 15) + (V / 10) + 5B$
We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications.

T. A. Depretis
T. A. Depretis, Metallurgist

Mill Test Report



NUCOR
PLATE MILL

P.O. Box 279
Winton, NC 27986
(252)-356-3700

DEC-24-01

03:33

FROM

Date: 11/12/01 B/L No.: 11928 Load Req. No.: 13196

Our Order No.: 4247-1

Cust. Order No.: NEW-191199

Specification: .750" x 96.000" x 240.000

ASTM A36-00/ASTM A709 Grade 36-00/ASME SA3696

CHARPY V-NOTCH TESTED 15 FT LBS @ 10°F (FREQ H, LONG)

Sold/NAMASCO Corporation Southwest

To: 4501 N. Miro Street

New Orleans, LA 70117

NAMASCO NEW ORLEANS (TRK)

Ship To: 4501 N. Miro Street

New Orleans, LA 70117

Heat No.	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al	V	Nb(Cb)	Ti	N	Ca	B	Sn	Ceq	pcm
1103242	.20	.92	.009	.001	.26	.25	.06	.07	.00	.028	.004	.001							

Plate Serial No.	Tensile Test				Charpy Impacts (ft-lbs)								
	Pieces	Yield (psi)	Tensile (psi)	Elongation (% in 2")	Elongation (% in 8")	Dir.	1	2	3	Ave.	Size {mm}	Temp {°F}	Temp {°C}
1103242-03	8	48,100	75,100		23.4	L.	111.7	121.7	100.2	111.2	10.0	+10°F	15
		40,900	70,200		20.3								

+2523563903

T-034 P.003/003 F-944

Manufactured to a fully killed fine grain practice. Welding or weld repair was not performed on this material. Melted and manufactured in the USA. Yield by SEUL method.
Mercury has not been used in the direct manufacturing of this material.
Ceq=C+(Mn/6)+((Cr+Mo+V)/5)+((Cu+Ni)/15)
pcm=C+(Si/20)+(Mn/20)+(Cu/20)+(Ni/60)+(Cr/20)+(Mo/15)+(V/10)+5B

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications.

T. A. Depretis
T. A. Depretis, Metallurgist



ipscor steel inc.

12400 Highway 43 North, Lenoir, AL 36505-4308

Test Certificate

Form TC1: Revision 1: Date 31 Oct 2000

Customer: O'NEAL STEEL INC. ONE ONEAL LANE MOBILE, AL 36671		Customer P.O. No.: 776780P168		MIL Order No.: 18-004125-01		Shipping Manifest : 507341							
Product Description: ABS (2001)-DH36/AH36,ASTM A572-50-12 LCVN 25 Ft. LBS. 0-22 DEG. F /A673-H		Ship Date: 17 Feb 02 Cert Date: 17 Feb 02		Cert No: 01585									
Size: 1.000 X 96.00 X 480.0 (IN)													
Tensiles		Charpy Impact Tests											
Heat Id	Piece Id	Piece Dimensions	YS (PSI)	UTS (PSI)	Elong % of 2in	Bend Test 8in	Average Hardness	Absorbed Energy 1 2 3 Avg	% Shear 1 2 3 Avg	Test Temp	Test Dir	Test Size	ROWTT
W11634 A19	1.001 X 96.37		57000	71000	25			220 236 231 229		-22 F	L	3/4	
Chemical Analysis													
Heat Id	C	Mn	P	S	Si	Tot Al	Cr	Mo	Cu	V	Ti	CEV	
W11634	.06	1.32	.011	.003	.19	.029	.06	.02	.001	.063	.003	.33	

ABS AMERICAS
SURVEYOR
FEB 28 2002
(SIGNED)
MOBILE, AL - DATE

ABS
AMERICAN BUREAU OF SHIPPING
MOBILE

02W28627 1

100 % MELTED AND MANUFACTURED IN THE USA / DIN 50049 PAR 3.1B COMPLIANCE
W11634 A19 PIECES: 1, WEIGHT: 13135

(U) Cust Part # : 809133/0436311	WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH THE APPROPRIATE SPECIFICATION Jim O Rear QA-METALLURGY
----------------------------------	---

Material Traceability Log

CRANE WO. NO.: 020209

CUSTOMER: S.W. PETROLEUM SERVICES/ PEMEX

WELDMENT PART NO.: N61535

WELDMENT S/N: N/A

DESCRIPTION: Hoist Weldment (Auxillary)

MODEL: 180B-60

CHECKED BY: Pauline L. L. L.

DATE: 6-12-02

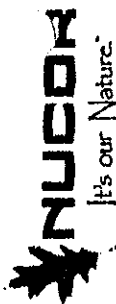
[illegible]

10. Austy

NUCOR
P.O. Box 279
Winston, NC 27986
(252) 356-3700

Mill Test Report

Page 1



Issuing Date: 11/12/2001

Load No.: 13427

Our Order No.: 42151

B/L No.: 11884

Cust. Order No.: 1060949

Specification: .5" x 96" x 240"

ASTM A36-00/ASTM A709 Grade 36-00/ASME SA36-96

Sold To: ONEAL STEEL INC
P O BOX 98

Ship To: ONEAL STEEL GREENSBORO
301 STANDARD DRIVE

Marking: 0426001 ✓ 805829

BIRMINGHAM, AL 35201

GREENSBORO, NC 27409

Test Result Note:

Heat No.	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al	V	Nb (Cb)	Ti	N	Ca	B	Sn	Ceq	pcm
1103257	0.16	0.95	0.011	0.004	0.13	0.25	0.07	0.08	0.01	0.072	0.003	0.001	0.005	0.0000	0.0020		0.011	0.358	0.218
Tensile Test										Charpy Impacts (ft-lbs)									
Plate Serial No	Pieces	Yield (psi)	Tensile (psi)	Elongation (% in 2")	Elongation (% in 8")	Dir.				1	% shear	2	% shear	3	% shear	Ave.	Size	Temp.	Min Ave
1103257-01	3	44,900	68,900		24.2														
		47,100	70,300		24.3														

Manufactured to fully killed fine grain practice. Welding or weld repair was not performed on this material. Melted and manufactured in the USA. Yield by 0.5EUL method. Mercury has not been used in the direct manufacturing of this material.

$$Ceq = C + (Mn / 6) + ((Cr + Mo + V) / 5) + ((Cu + Ni) / 15)$$

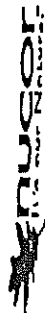
$$Pcm = C + (Si / 30) + (Mn / 20) + (Cu / 20) + (Ni / 60) + (Cr / 20) + (Mo / 15) + (V / 10) + 53$$

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications.

T. A. Depretis

T. A. Depretis, Metallurgist

Mill Test Report



NUCOR
PLATE MILL

P.O. Box 278
Winton, NC 27986
(252)-356-3700

DEC-24-01 03:33 FROM-

Date: 11/12/01 B/L No.: 11828 Load Req. No.: 13196

Our Order No.: 4247-1 Cust. Order No.: NEW-191199

Specification: .750" x 98.000" x 240.000

ASTM A36-00/ASTM A709 Grade 36-00/ASME SA3698

CHARPY V-NOTCH TESTED 15 FT LBS @ 10°F (FREQ H, LONG)

Sold to NAMASCO Corporation Southwest
To: 4501 N. Miro Street
New Orleans, LA 70117

NAMASCO NEW ORLEANS (TRK)
Ship To: 4501 N. Miro Street
New Orleans, LA 70117

Heat No.	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Al	V	Nb (Cb)	Ti	N	Ca	B	Sn	Ceq	pcm
1103242	.20	.92	.009	.001	.28	.25	.06	.07	.00	.028	.004	.001							

Tensile Test

Plate Serial No.	Pieces	Yield (psi)	Tensile (psi)	Elongation (% in 2")	Elongation (% in 8")	Dir.	1	2	3	Ave.	Size (mm)	Temp (°F)	Min Av
1103242-03	8	48,100	75,100		23.4	L	111.7	121.7	100.2	111.2	10.0	+10°F	15
		40,900	70,200		20.3								

Charpy Impacts (ft-lbs)

Manufactured to a fully killed fine grain practice. Welding or weld repair was not performed on this material. Melted and manufactured in the USA. Yield by SEUL method.
Mercury has not been used in the direct manufacturing of this material.
Ceq = C + (Mn/6) + ((Cr + Mo + V)/5) + ((Cu + Ni)/15)
pcm = C + (Si/20) + (Mn/20) + (Ni/60) + (Cr/20) + (Mo/15) + (V/10) + 5B

We hereby certify that the contents of this report are accurate and correct. All test results and operations performed by the material manufacturer are in compliance with the applicable specifications.

T. A. Dapreis
T. A. Dapreis, Metallurgist

+2523563903

T-034 P.003/003 F-044



psco steel inc.
12400 Highway 43 North, Lenoir, AL 36505-4308

Test Certificate

Form TC1: Revision 1: Date 31 Oct 2000

Customer: O'NEAL STEEL INC. ONE O'NEAL LANE MOBILE, AL 36671		Customer P.O. No.: 776780P168		Mill Order No.: 18-004125-01		Shipping Manifest: 507341							
Product Description: ABS (2001)-DH36/AH36,ASTM A572-50-F2 LCVN 25 FT. LBS. 0-22 DEG. F /A673-H				Ship Date: 17 Feb 02		Cert No: 015835							
Size: 1.000 X 96.00 X 480.0 (IN)													
Tensiles				Charpy Impact Tests									
Heat Id	Piece Id	Piece Dimensions	YS (PSI)	UTS (PSI)	Elong % of 2in 8in	Average Hardness	Absorbed Energy 1 2 3 Avg	% Shear 1 2 3 Avg	Test Temp	Test Dir	Test Size		
W1L634 A19	11.001 X 96.37		57000	71000	25		220 236 231 229		-22 F	L	3/4		
Chemical Analysis													
Heat Id	C	Mn	P	S	Si	Tot Al	Cu	Ni	Cr	Mo	V	Ti	CEV
W1L634	.06	1.32	.011	.003	.19	.029	.29	.09	.06	.02	.001	.063	.003 .33
100 % MELTED AND MANUFACTURED IN THE USA / DIN 50049 PAR 3.1B COMPLIANCE													
W1L634 A19 PIECES: 1, WEIGHT: 13135													
Cust Part # : 809133/0436311				WE HEREBY CERTIFY THAT THIS MATERIAL WAS TESTED IN ACCORDANCE WITH THE APPROPRIATE SPECIFICATION									
				Jim O Rear QA METALLURGIST									

ABS AMERICAS
SURVEYOR
(SIGNED) *[Signature]*
MOBILE, AL - DATE **FEB 28 2002**



02W28627 1

PIN CERTIFICATES

Box Boom Style

PIN CERTIFICATE SHEET

DATE: 12APR02 REV: WORK ORDER NO.: 020209C

CUSTOMER: PEMEX EXPLORATION MODEL NO.: 180B-60

MATERIAL: SS = Stainless Steel with 100,000 PSI Minimum Yield		4140 = 4140 with 100,000 PSI Minimum Yield						
COATING: U = Uncoated		F = Fluorocarbon Coated S = Special						
COMPONENTS	PART NUMBER/REV.	PIN NO.*	HEAT NO.	MATERIAL		COATING (4140 Only)		
				SS	4140	U	F	S
BOOM FOOT PIN	N61945-001 (1) Rev. A	P1	42874	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CYLINDER TO BOOM	N60006-093 (2) Rev. L	P2 P3	G3385 G3385	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CYLINDER TO TURRET	N61297-002 (2) Rev. F	P4 P5	42874 42874	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
UPPER MAIN SHEAVE	N61308-001 (1) Rev. A	P6	A44288	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LOWER MAIN SHEAVE	N61308-002 (1) Rev. --	P7	A44288	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AUXILIARY EXTENSION	N61010-006 (1) Rev. E	P8	327080	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EXTENDED WEDGE SOCKET PIN	N60645-001 (1) Rev. A	P9	H1358	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LOAD CELL PINS	N60646-004 (2) Rev. A	P10 P11	H1358 H1358	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

NOTES: * Pin number to be stamped on end of pin by machinist.
 ** Heat Number to be recorded by machinist when material is pulled from inventory.

SPECIAL COATING REQUIREMENTS:

Thereby certify that this data is correct as
contained in the records of this company.

PART NO.

Attn: HBLIN-PO# 6238



SLOVENSKE ŽELEZARNE
METAL-RAVNE d.o.o.

PODJETJE ZA PROIZVODNJO PLEMENTIH JEKEL
2390 Ravne na Koroškem
Koroška c. 14

Certificate

NO: 113 4384

Slovenija
Telex: 33 114 si zelrv
Telefon: 02 8221 131
Fax: 02 8220 436

Ravne, 20. 12. 2001

Purchaser:

Contract number: B6X64 Order number: 79051

Subject: FORGED BARS

Heat treatment: SOLUTION ANNEALED

Specifications F.H.S Steel-DH 1150

Drawing	Cast no.	Grade of steel	No. of Batch	Yield Str. at 0.2% Offset P.S.I.	Tensile Str. P.S.I.	Elongat. in 50 mm %	Reduct. of Area %	Hardness BHN
5"	42874	17-4 DH1150	6	118.056	135.315	21.0	68.0	32- 32

Side expansion: 0,97; 1,35; 1,31 mm
ISO-V-60°C=100,120,135 J

Chemical Analysis

Cast No.	C	Si	Mn	P	S	Cr	Ni	Mo	V	Cu	N	Al	B	Ti	Nb	N2
42874	0.029	0.49	0.60	0.031	0.020	15.24	4.26	0.30		3.38						

	Co	H2	O2	As	Sb	Sn	Ca	Pb	Fe	Zr	Cb+Ta
42874											0.265

Note:

Free from of mercury contamination.

Solution annealed: 1904°F-1h/Water

Age hardening: 2x 1148°F-4h/Air

Specifications:

Inspection department
Mr. B. B. dipl. inž.
Chet

Slovenske železarnice
METAL-RAVNE d.o.o.
Ravne na Koroškem

Albi: Steve

NORTEC
 specialty steels


ENTERED FEB 05 2000


Universal Stainless & Alloy Products, Inc.

 600 Mayer Street • Bridgeville, PA 15017
 (412) 257-7600

 ISO-9002 CERTIFIED
 QUALITY SYSTEM

Material Certification

 Order: 45526- 1 Customer Order: KREHER STEEL CO., INC. - 67064
 MELROSE PARK, IL 60160

 Material: 17-4 AGED, SMOOTH TURNED ROUND BAR.
 Spec: AMS 5643P, ASTM A564, H1150

Cert: SHOW MELT TYPE, REDUCTION RATIO, REPT ALL RESIDUALS ON CERTS

Size: x x 20'6" - 22'6"

Melt Type: AOD Condition/Finish: HOT ROLL, AGED, TURN 125RMS MAX, SAW CUT

Heat Number	C	0.033	Cr	15.38	Co	0.060	Ta	<0.01
	Mn	0.73	W	<0.05	Cu	3.30	Al	<0.01
G3385	Si	0.28	V	0.06	Sn	0.007	Ti	<0.01
L	S	0.002	Ni	4.41	Pb		B	<0.001
	P	0.027	Mo	0.32	Ch	0.260	N	0.026

(chemical analysis performed according to ASTM B572 & E1019) C/E:

4.000" x 18'10" 17-4 H1150 (802#) shipped to Tri-Coastal
 Alloys on 4/19/02 (Heat# G3385) meets the mechanical property
 requirements of ASTM A-564 i.e.

135 ksi min Tensile

105 ksi min Yield

16 % min Elongation

50% min Red A

277 min Brinell

R. Maddison

Nortec Specialty Steels

Seite
Page 1 / 1Zeugnis-Nr.
Certificate no.
No. de certificat 138448Bescheinigung über Werkstoffprüfung nach EN 10204
Certificate of material tests according to EN 10204
Certificat des essais des matériaux selon EN 10204

3.1.B

Die Lieferung entspricht den vereinbarten Lieferbedingungen.
The above mentioned material have been delivered in accordance with the terms of the order.
La livraison correspond aux conditions de livraison convenues.

BGH Edelmetall Freital GmbH, Postfach 1566, D-01691 Freital


BGH
EDELSTAHL FREITAL
Kunden-Bestell-Nr.
Customer order no.
Cdo. no. du client 90546-000 Energy
BGH 01-0320-01BGH-Auftrags-Nr.
BGH works no.
BGH référence 08030101/32430Zeichen des Lieferwerkes
Trade mark
Signe du fournisseur
Stempel des Werkstoffverständigen
Inspector's stamp
Poinçon de l'inspecteur

Erzeugnisform Product		Stabstahl, rund, gewalzt, geschält/poliert Round bars, rolled, peeled/polished										
Werkstoff / Quality		17/4 PH (DBH1150)										
Anforderungen Requirements		ASTM A 564 1999a SPEC 630DBH-RD-01 06/17/98 Rev 3, SPEC 630DBH-RD-02 06/18/98 Rev 3, ASTM A370 -97a, A484 -98, ASME SA564 -98, SA484 - 98, AMS 5643N -01/92, AMS 2303C (Mag particle test) -01/93 NACE MR-0175-2000										
Besichtigung und Maßnachprüfung Inspection and dimensional control		Erwärmung/Nachbehandlung Melting process/secondary refining				Verwachsungsprüfung (spectroanalytisch) Identification test (spectral analysis)						
ohne Beanstandung without objection		E - VOD				ohne Beanstandung without objection						
Pos. Item	Anzahl Quantity	Abmessung Dimension		Gewicht kg Weight kg		Schmelz-Nr. Heat-No.						
1	12	4.00"dia.		6524 lbs		11812						
Schmelz- Heat %	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	Nb	N2	Ta
11812	0,027	0,24	0,62	0,028	0,004	15,75	0,19	4,12	3,32	0,270	0,0280	0,004
Wärmebehandlungszustand Condition of heat treat		Lösungsgeglüht + 2x ausgehärtet solution annealed + 2x precipitation hardening										
Probe-Nr. Test-No.	Lage Pos./Req.	Temp. °F	Rp0,2 ksi	Rm ksi	A4 %	A %	Kerbschlagarbeit Impact value ft-lbs	Probenform Shape of test piece Charpy-V	Härte HRC Hardness			
335HD1	L	+68	114	136	23	68	40	35	42	-75	29-32	
Prob-Nr Test-No	Temp °F	later. Breitung mm later. extension		Scherbruchant. % shear fracture								
335HD1	-75	0,6 0,5 0,7		50 45 50								
Ferritgehalt/ferrite=2,6% Verformungsgrad/reduction ratio=13:1												
MATERIAL FREE FROM MERCURY CONTAMINATION, MATERIAL NO WELD REPAIR.												
TEST PIECES TAKEN FROM ACTUAL BAR PROLONGATION x 6" LENGTH												
AMS 2303C (Mag particle test): without objection												
Country of origin: Germany												
Anlagen US-certificate / Protokoll End Annexe Gießbesch./Heat treatment cer				Freital, den Place and date Lieu et date 18.09.2001				Der Werkstoffverständige Works-Inspector L'expert de l'usine OESER				
Das Zeugnis wurde maschinell erstellt und ist ohne Unterschrift gültig.												
This certificate was generated by data system & must not be signed for validity. Ce certificat a été établi sur système informatique et est valable sans signature												

Zeugnis-Nr.: 138448
Certificate no.:
No. de certificat:

Kunden-Bestell-Nr.: 90546-000 Energy
Customer order no.:
Cde. no. du client

BGH-Auftrags-Nr.: 080301-01
BGH-works no.
BGH-référence:

Erzeugnisform : Stabstahl, rund, gewalzt, geschält/poliert
Product : Round bars, rolled, peeled/polished
Werkstoff / Quality : 17/4 PH (DBH1150)
Abmessung/Dimension : 4.00"dia.

Wärmebehandlungszustand : lösungsgeglüht + 2x ausgehärtet
Condition of heat treat : solution annealed + 2x precipitation hardening

Prüfrichtlinie
Specification

US: nach ASTM/ASME A 368
max. 3 mm KSR/FBH

Bearbeitungszustand : geschält/poliert
Machining condition : peeled/polished
Prüfgerät : Deutsch Echograph 1016
Test equipment
Prüfkopf : S12W4

Probe

Kopplungsmittel : Wasser/Leim
Coupling medium : water/glue

Prüfumfang : vollständig
Extent of examination : completely

Einschallrichtung : radial
Direction of incidence : radial

Transferkorrektur :
Transfer correction

Schallschwächung :
Wave attenuation


Registr./Zuläss.-grenze : Prüfung und Justierung erfolgten gemäß obiger Spezi-
fikation

Register/acceptance level : Test and adjustment acc. a. m. specification.

Befund : Es wurden keine registrierpflichtigen Anzeigen ermi-
ttelt.

Result : There have not been found any reportable indications.

01691 Freital, den
Place and date
Lieu et date
19.09.01

Die geprüften Stücke wurden mit dem Stempel  versehen.
The test pieces have the following stamp:
Les pièces contrôlées sont repérées par le cachet suivant:

Level III SNT-TC 1A


JAKOB



Werkssachverständiger
Works-Inspector
L'expert de l'usine

Wärmebehandlungsbescheinigung
Heat treatment certificate
Attestation de traitement thermique



Zeugnis-Nr.: 138448
 Certificate no.:
 No. de certificat:

Kunden-Bestell-Nr.: 90546-000 Ener
 Customer order no.:
 Cde. no. du client:

BGH-Auftrags-Nr.: 08030101
 BGH-works no.:
 BGH-référence:

Wärmebehandlungszustand: **lösungsgeglüht + 2x ausgehärtet**
 Condition of heat treatment: **solution annealed + 2x precipitation hardening**
 État de traitement thermique: **recuit de mise en solution + durci précipité 2x**

Datum: 19.07.2001
 Date:
 Date:

Ofen-Nr.: 473
 Furnace no.:
 No. du four:

Aufheizzeit: 3 h
 Heating up time:
 Temps de montée en température:

Haltetemperatur: 1040 °C
 Holding temperature:
 Température de maintien:

Haltezeit: 2,5 h
 Holding time:
 Temps de maintien

Abkühlmedium: Luft / air / air
 Quenching medium:
 Moyen de refroidissement:

Datum:	24.07.2001	30.08.2001
Date:		
Date:		
Ofen-Nr.:	405	410
Furnace no.:		
No. du four:		
Anlaßtemperatur:	630 °C	630 °C
Tempering temperature:		
Température de revenu:		
Haltezeit:	6 h	6 h
Holding time:		
Temps de maintien:		
Abkühlmedium:	Luft / air / air	Luft / air / air
Quenching medium:		
Moyen de refroidissement:		

Wärmebehandlungs-Nr.: 410/786
 Heat treatment lot no.:
 No. du lot de traitement thermique:

Material cooled below 32 °C.
Annealing practice in acc. method A.

Diagramm:
 Diagram:
 Diagramme:

Datum: 19.09.2001
 Date:
 Date:

Der Sachverständige:
 The Inspector:
 L'inspecteur:

BGH
 Q414

PO/Rel

I hereby certify that this data is correct as
contained in the records of this company.

Attn: HIBLEN-POH 6170

PART NO.


SLOVENSKE ŽELEZARNE
METAL RAVNE d.o.o.

 PODJETJE ZA PROIZVODNJO PLEMNITIH JEKEL
 2390 Ravne na Koroškem
 Koroška c. 14

Certificate

No: 113 4456

 Slovenia
 Telex: 33 114 si zelrv
 Telefon: 02 8221 131
 Fax: 02 8220 436

Ravne, 20.12.2001

Purchaser: KREHER HOUSTON

Contract numbers: B6X64 Order number: 79051

Subject: FORGED BARS

Heat treatment: SOLUTION ANNEALED

Specifications P.H.S Steel-DH 1150

Drawing	Cast no.	Grade of steel	No. of Batch	Yield Str. at 0.2% Offset P.S.I.	Tensile Str. P.S.I.	Elongat. in 50 mm %	Reduct. of Area %	Hardness BHN
4"	42874	17-4 DH1150	B	118.056	135.315	21.0	68.0	30- 31
Side expansion: 0,97; 1,38; 1,31 mm ISO-V-60°C=100,120,135 J								

Chemical Analysis

Cast No.	C	Si	Mn	P	S	Cr	Ni	Mo	V	Cu	W	Al	B	Ti	Nb	N2
42874	0.029	0.49	0.60	0.031	0.020	15.24	4.26	0.30		3.38						
42874	Co	H2	O2	As	Sb	Sn	Cu	Pb	Fe	Zr		Ch+Ta				
												0.265				

Note:

Free from mercury contamination.

Solution annealed: 1904°F-1h/Water

Age hardening: 2x 1140°F-4h/Air

Specifications:

 Inspection department
 Hrčič Bonja dipl.inž.
 Chief

 Slovenske železarnе
METAL RAVNE d.o.o.
 Ravne na Koroškem

p.2

2014618824

Kopo International

FEB 06 02 12:04p

Certificate of Mill Test Results

1-000000-000

Pg 1/1

PO/Ref

I hereby certify that this data is correct as
contained in the records of this company.

Attn: HILBN-POM 5776

PART NO.

Inspection Certificate



CHANGWON SPECIALTY STEEL

Changwon Works
P.O. BOX 25, Changwon, Korea
Telefax: 82-551-269-6907

*P/O NO: D107-

#1REF. CD: D535

Customer :

Order No. : P11-07665 (KRR10U81C)

Cert No. : 10430-13-25651

Specification: ASTM A564-99

Melting Process : E.A.F + V.O.D.

Steel Grade : T-63U

Surface Condition : ROUGH TURNED

Article : ROUND BAR

Heat Treatment : SOLUTION TREATED

77005-10

3 Y2

Bundle No.	Lot No.	Dimensions		Quantity	Mass		Test No.
		Size	Length		kg	lb	
13-25651	1107663000	3.530 IN.	20FT-22FT	4	1315	2899	6650-1
13-25652	1107665000	3.530 IN.	20FT-22FT	4	1313	2895	
13-25653	1107665100	3.530 IN.	20FT-22FT	3	990	2183	6651-1
13-25654	1107665100	3.530 IN.	20FT-22FT	3	991	2185	
TOTAL				14	4609	10162	

Heat No.		Chemical Composition (%)										
		C	Si	Mn	P	S	Ni	Cr	Mo	CU	CO	RE+TA
Spec.	min.						3.00	15.00		3.00		1.500
	max.	.070	1.00	1.00	.0400	.0300	5.00	17.50	.500	5.00	.200	.4500
A44288		.039	.41	.73	.0256	.0049	4.14	15.73	.214	3.10	.085	.2730

Test No.		Mechanical Properties										
		Yield Strength KSI	Tensile Strength KSI	Elongation %	Reduction of Area %	Hardness Test		Impact Test			Decarburization Test mm	Grain Size Test
						Body HB	Lab- AG HRC					
Spec.	min. max.					363						
6650-1		119	150	15.0	46.0	311						7.5
6650-2		177	198	18.0	63.0		42.2					
6651-1		118	150	13.0	53.0	311						7.5
6651-2		177	198	18.0	63.0		42.2					

ULTRA SONIC TEST	MACRO STRUCTURE TEST	MICRO STRUCTURE TEST	Non-Metallic Inclusions Test							
			KS / JIS (%)		A S T M					
			A		TYPE	A	B	C	D	
			B+C		THIN					
GOOD	GOOD	GOOD	A+B+C		HEAVY					
Hardenability Test (HRC)	Distance ()									
	No. 1									
	No. 2									
	Distance ()									
	No. 1									
	No. 2									

Additional Remarks : N : .0099% AG: AGING

FREE FROM MERCURY CONTAMINATION. MICRO & MACRO TEST : GOOD.
INTERGRANULAR CORROSION (ASTM A262 PRACTICE E) TEST : GOOD.
NO WELD REPAIR. MADE IN KOREA. CERT. TO: ASTM A564-95A, A484-98.
A479-99, A370-97A. ASME SA564-98 TYPE 630, SA484-98, AMS 5643P.
UNS S17400. HEAT TREATMENT : 1050 C & W.C. NACE MR 01-75-95

We hereby certify, that the material described above has been
tested and complies with the terms of the order contract.

APR. 30. 01

Date

Quality Technology Team Manager

Bodycote MATERIALS TESTING

METAL TECHNOLOGY

Bodycote Omnitest Inc., Omnitest Laboratory, 4302 Mayo Street, Houston, Texas, 77092
Tel: 7139398600, Fax: 7139390249

PAGE 02



Test Certificate

BODYCOTE LINDBERG - T.P.
P.O. BOX 30070
HOUSTON, TX

REF No 0001039 : Issue 1
Ord No 157515

Date Tested 02/07/02
Date Reported 02/07/02

77249-0070

Attn: QUALITY CONTROL (HAYS)

Item - PN/DESC: 3 1/2" DIA X 6" LG MTL: 17-4
CUST: TRI COASTAL ALLOYS PO: 6098 H/N: A44288

Specification - ASTM A564 (H1150)

Tensile Test - A564 (H1150)								
	Dimensions [in]	Area [in ²]	QL [in]	0.20kYS [psi]	UTS [psi]	%EL	RA	Comments
001:Longitudinal	0.4990	0.1966	2.00	137100	146000	17.0	82.1	Nil

Certificate Comments

TEST RESULTS CONFORM TO SUPPLIED REQUIREMENTS.

Approved By J. Blevins

J. Blevins
For and on authority of
Bodycote Omnitest Inc.

This certificate should not be reproduced other than in full, without the written approval of Bodycote Materials Testing Inc.
These results pertain only to the item(s) tested as sampled by the client unless otherwise indicated.

Page 1 of 1

TOTAL P.01

HOUSTON TX 77269

SUITE A
HOUSTON

TX 77269

PAGE 01
CUS# 41024
DATE: 08-Feb-02

We are pleased to submit our CERTIFICATION OF HEAT TREATMENT of the following:

Purchase Order No.	Packing List No.	Entry Date	Material
6098		02/05/02	17-4 PH
6 HT# A44288	BAR STOCK	3-1/2"DIA X 22'R/L	

The descriptions / specifications are as follows:

17-4: AGE HARDEN H-1150
SUR: HRC 28 37

We hereby certify that the above parts were given the following Heat Treatment.
That temperatures & test results were obtained with standard approved methods.

PROCESS	FURN#	TIME	TEMP.	QUENCH
AGE HARDEN	501	5.00 HOURS	1150 F	AIR

INSPECTION: 1 PIECE CHECK 321 BHN (34 HRC)

MECHANICAL PROPERTIES TESTED AT BODYCOTE OMNITEST. REF# 0001039

All processes involved in the production of these articles and requiring specific process approval have been so approved and certificates are on file subject to examination.

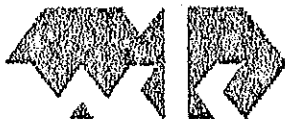
LINDBERG HEAT TREATING COMPANY

Paul C. Plughan
Authorized Signature - Title



Certified Company

Datum/Date : 03.07.00

**EDELSTAHL WITTEN-KREFELD GMBH**

Austraße 4
D-58452 Witten
Telefon: (02302)29-0
Telefax: (02302)29-40 00
Postanschrift: D-58449 Witten

Seite/Page: 1 / 3

Zertifiziert nach:	ISO 9001 VDA 6, Teil 1	ADW 0 TRD 100
--------------------	---------------------------	------------------

Abnahmeprüfzeugnis nach
Inspection Certificate acc.to / Certificat de réception selon
Zeugnis-Nr. / Certificate No. / No.de Certificat

DIN EN 10204 3.1B

161310 / 432669 / bit

Edelstahl Witten - Krefeld GmbH, D-58449 Witten

Herstellerzeichen / Supplier's Mark / Marque d'usine	
Prüfstempel / Inspector's stamp / Poinçon de l'expert	

Warenempfänger

Ihre Auftr.-Nr. Your order No. / No.de votre commande	Bestelldatum Date of order / Date du commande
01D00087	06.03.00
Unsere Auftr.-Nr. Our order No. / No.de notre Commande	Unsere Material-Nr. Our material No. / No.de notre matière
1241292 / 000001	2115189
Unsere Abteilung / Our department / Notre département	Telefon / Telephone / Téléphone
0001	02302 / 294233

Produkt / Product / Produit

STAINLESS STEEL BARS
TYPE 630 (17-4 PH), H 1150
HOT ROLLED, SOLUTION TREATED AND AGE
HARDENED, STRAIGHTENED, PEELED
ASTM A 564-97, ASME SA 564-95, AMS 5643 N,
UNS-S-17400, NACE MR 01/75

Fertigungsauftr.-Nr. / Production lot-No. / Lot de fabrication No. : 38599
Lieferschein-Nr. / Delivery note / No. de l'avis de livraison :
Schmelzen-Nr. / Heat No. / No.de coulée : 327080
Stückzahl / Piece No. / Nombre des pièces :
Gewicht / Weight / Masse :
Zeichnungs-Nr. / Drawing No. / No.du dessin :
Format / Shape / Profil : rund / round / rond
Durchm./Brelte / Diameter/width / Diamètre/largeur : 64.770 [mm] / 2.550 [in]
+ 0.508 / - 0.000 [mm]
Dicke / Thickness / Epaisseur :
Länge / Length / Longueur : 7300 - 8200 [mm]
287.402 - 322.835 [in]

Stückzahl und Gewicht siehe Rechnung.

Quantity and weight see delivery bill/invoice. / Nombre des pièces et masse voir facture.

Lieferzustand / Condition as supplied / Etat de livraison : 1040 °C / Water + 620 °C 2 H / Air
NO WELDING HAS BEEN PERFORMED

Die Prüfergebnisse zu Ihrer Lieferung finden Sie auf der Rückseite bzw. den nächsten Seiten
As for test results of your delivery see overleaf. / Vous trouverez les résultats d'essais de votre livraison à les pages suivantes.

EDELSTAHL WITTEN-KREFELD GMBH

Abnahmetechnik / Inspection department / Département de Réception

Krause

Der Werkssachverständige

Works' inspector / L'Agent Réceptionnaire de l'usine

Dieses Zeugnis wurde maschinell erstellt und ist gemäß DIN EN 10204 auch ohne Unterschrift gültig.
This certificate has been generated by computer and need not to be signed for validity according to DIN EN 10204.
Le certificat a été établi sur système informatique et est aussi valable selon DIN EN 10204 sans signature.



Certified Company

EDDELSTAHL WITTEN-KREFELD GMBH

Auestraße 4
D-58452 Witten
Telefon: (02302)29-0
Telefax: (02302)29-40 09
Postanschrift: D 58449 Witten

Datum/Date : 03.07.00

Seite/Page: 2 / 3

Zeugnis-Nr. Certificate No. / No.de Certificat	Unsere Auftr.-Nr. Our order No. / No.de notre commande	Ihre Auftr.-Nr. Your order No. / No.de votre commande	Fertigungsauftr.-Nr. Production lot-No. / Lot de fabrication No.
161310 / 432669 / bit	1241292 / 000001	01100087	38599

Schmelzen-Nr. / Heat No. / No.de coulée	Erschmelzungsart / Steelmaking process / Procédé d'élaboration	Sekundärmetallurgie / Secondary metallurgy / Metallurgie secondaire
327080	E	VOD

Chemische Zusammensetzung / Chemical Composition / Composition chimique

	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	Nb	
Ist / Actual / Actuel	0.021	0.49	0.94	0.022	0.001	16.36	0.04	4.65	3.26	0.22	(%)

Härte / Hardness / Dureté

Lieferzustand / Condition as supplied / Etat de livraison

Proben-Nr. / Specimen-No. / No.d'éprouvette	HRC
39042	32

Härte / Hardness / Dureté

Lieferzustand / Condition as supplied / Etat de livraison

Proben-Nr. / Specimen-No. / No.d'éprouvette		39042
Ist / Actual / Actuel		303 [HB]

Zugversuch / Tensile test / Essai de traction

Lieferzustand / Condition as supplied / Etat de livraison

Probenabm. / Specimen dimension / Dimension d'éprouvette	Probenrichtung / Specimen direction / Sens de Prélèvement		Prüftemp. / Test temperature / Température d'essai			
Zugprobe; 12,5 mm rd	längs / longitudinal / longueur		23 [°C]			
Proben-Nr. / Specimen-No. / No.d'éprouvette	Rpo.2 [MPa (N/mm²)]	Rpo.2 [Ksi]	Rm [MPa (N/mm²)]	Rm [Ksi]	A2'' [%]	Z [%]
39041	799	116	1010	147	21.4	61

Schlagbiegeversuch / Impact test / Essai de résilience

Lieferzustand / Condition as supplied / Etat de livraison

Probenform / Type of specimen / Type d'éprouvette	Probenrichtung / Specimen direction / Sens de Prélèvement	Prüftemp. / Test temperature / Température d'essai	
[CHARPY V]	längs / longitudinal / longueur	23 [C°]	
Proben-Nr. / Specimen-No. / No.d'éprouvette	1. Prfl. / Spec. / Epreuve	2. Prfl. / Spec. / Epreuve	3. Prfl. / Spec. / Epreuve
39041	166 [J]	170 [J]	170 [J]

Gefügeuntersuchung / Examination of microstructure / Examen de structure

MICRO- AND MACROSTRUCTURE NO OBJECTIONS

Ferritgehalt / Ferrite content / Contens de ferrite

Proben-Nr. / Specimen-No. / No.d'éprouvette	Ferrit / Ferrite / Ferrite
39042	5 [%]

Delivery has been checked by US-testing

Identity has been checked (Spectro.)

Testing for surface cracks has been performed.

Visual inspection and control of dimensional accuracy have been performed

2 1/2

QS 9000



Certified Company

Datum/Date : 03.07.00



EDELSTAHL WITTEN-KREFELD GMBH

Anstraße 4
D-58452 Witten
Telefon: (02302)29-0
Telefax: (02302)29-40 00
Postanschrift: D-58449 Witten

Seite/Page: 3 / 3

Zeugnis-Nr. Certificate No. / No.de Certificat	Unsere Auftr.-Nr. Our order No. / No.de notre Commande	Ihre Auftr.-Nr. Your order No. / No.de votre commande	Fertigungsauftr.-Nr. Production lot-No. / Lot de fabrication No.
161310 / 432669 / bit	1241292 / 000001	01D00087	38599

Erläuterung/ Explanations/ Explications

■ **Erschmelzungsart / Steelmaking process / Procédé d'élaboration :** E = Elektrostaht / Electric-arc-furnace steel / Acier électrique
 ■ **Sekundärmetallurgie / Secondary metallurgy / Metallurgie secondaire :** VOD = Vakuum-Sauerstoff-Entkohlungs-Verfahren / Vacuum-Oxygen-Decarburization / Vacuum-Oxygène-Décarburation

Es wird bestätigt, daß die Lieferung geprüft wurde und den Vereinbarungen bei der Bestellsungsannahme entspricht.
 We hereby certify that the material described above has been tested and complies with the terms of the order.
 Nous certifions que la livraison été vérifiée et est conforme aux stipulations de l'acception de la commande.

CERTIFIED TEST REPORT

CUSTOMER:

SHIPPED TO:

0100429

TRI-COASTAL ALLOYS, LTD
7115 BELGOLD SUITE A
HOUSTON TX 77066

TRI-COASTAL ALLOYS, LTD

7115 BELGOLD SUITE A

ATTN: RECEIVING DEPARTMENT

HOUSTON

TX 77066

SALES DESCRIPTION:

1.2500 17-0PH1150 PSQ

SPECIFICATIONS

ASTM-A564-99 COND R1150

AMS 5643M SOLN ANNEALED 1900F

ITEM NO.	ORDER NO.	CUSTOMER P.O. NO.	
00077	0109543	4423	
WEIGHT SHIPPED	DATE SHIPPED	MELT SOURCE	COUNTRY OF ORIGIN
1959	07/00/00	KREHER STEEL COMPANY	USA

CHEMICAL ANALYSIS (%): HEAT # R1358

CARBON	MANGANESE	PHOSPHOR	SULFUR	SILICON	CHROMIUM	NITROGEN
.023	.52	.027	.015	.40	15.27	
COLUMBIUM	TANTALUM	COPPER	MOLYBDEN	NICKEL	VANADIUM	COBALT
.18	.01	3.150	.26	4.18		

MECHANICAL & PHYSICAL PROPERTIES: LOT

ER1706300

YIELD STRENGTH KSI 0.2% OFFSET	TENSILE STRENGTH KSI	ELONGATION % SIZE	REDUCTION IN AREA (%)	BRINELL
136,400	143,200	18	65	293

REMARKS:

THE RESULTS SHOWN ABOVE ARE CERTIFIED
TO BE A TRUE COPY OF TEST RECORDS
CONTAINED WITHIN OUR COMPANYNo welding was performed on this material.
This material is free from mercury contamination.

TEST REPORT CLERK

BALLRING CERTIFICATES

ROTEK, INC.

CERTIFICATION
VENDOR CODE 28666

DATE 4/6/01

This is to certify that Rotek Incorporated has manufactured, inspected and/or tested the product listed below, in accordance with the requirements of:

CUSTOMER NAME	<u>APPLIED HYDRAULIC SYSTEMS</u>
CUSTOMER PURCHASE ORDER NO.	<u>56205</u>
CUSTOMER PART NO.	<u></u>
CONTRACT NO. (PRIME)	<u></u>
ROTEK ORDER NO.	<u>1014878</u>
ROTEK PART NO.	<u>A1860E2</u>
QUANTITY	<u>10</u>
SERIAL NO.	<u>MO 67020- 1F THRU 10F</u>
COMMENTS (if any)	<u></u>
ATTACHMENTS	<u></u>

Tested in Accordance with the requirements of API Spec 2C, para 8.3.2, dated 4/3/95.
(where applicable)


Manager of Quality Control

Bearing

Serial #	Inner Serial No.	Cert. No.	Outer Serial No.	Cert. No.
MO67020-1F	J67020-4	52615 2068010	K67020-6	52652 1068022
MO67020-2F	J67020-5	52615 2068010	K67020-1	52615 2068020
MO67020-3F	J67020-3	52615 2068010	K67020-7	52652 1068022
MO67020-4F	J67020-2	52615 2068010	K67020-4	52652 1068022
MO67020-5F	J67020-1	52615 2068010	K67020-3	52652 1068022
MO67020-6F	J67020-9	52615 2068010	K67020-5	52652 1068022
MO67020-7F	J67020-10	52615 2068010	K67020-2	52588 1068021
MO67020-8F	J67020-8	52615 2068010	K67020-8	52652 1068022
MO67020-9F	J67020-6	52615 2068010	K67020-10	52652 1068022
MO67020-10F	J67020-7	52615 2068010	K67020-9	52652 1068022

Rotek Incorporated - Florence, Kentucky 41042 - (859) 342-8430

ROTEK FINAL INSPECTION REPORT

06-Apr-01

Model Number

A1860E2

Assembly Serial Number

MO67020-10F

ORDER	Inspection Requirement	Measured Value
1	REVISION LEVEL 1	1
2	REVISION DATE 5/14/96	5-14-96
3	INSPECTED BY	F9
4	DATE INSPECTED	4-5-01
5	INNER SERIAL NUMBER	J67020-7
6	OUTER SERIAL NUMBER	K67020-9
7	ASSEMBLY HEIGHT 5.50"	5.50
8	OUTER HEIGHT 5.13"	5.12
9	OUTER O.D. 68.785"	68.775
10	OUTER BOLT CIRCLE 64.250"	64.238
11	OUTER (54) HOLES TAPPED 1-1/4" - 7 UNC	FTG-13
12	OUTER (54) HOLES TAPPED 1.88" DP.	1.88
13	OUTER GEAR P.D. 68.9767"/68.9470" (.8125" BALLS)	68.973
14	AXIAL CLEARANCE .0047"/.0061"	.005
15	RADIAL CLEARANCE .006"/.010"	.0097
16	INNER HEIGHT 5.13"	5.12
17	INNER BOLT CIRCLE 54.500"	54.494
18	INNER (53) HOLES TAPPED 1-1/4" - 7 UNC	FTG-13
19	INNER (53) HOLES TAPPED 1.88" DP.	1.88
20	GREASE HOLE LOCATION	OK
21	STAMPING	OK

RELEASED BY

F10

1

CERTIFICATION OF TEST

CERTIFICATION NO. 526152068010



Customer Order No.	Rotek Order No.	SPECIFICATION	Date
FLO	MO68010	AISI 4340 MOD. PER API-2C	2/25/01

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P

Part No.	PCS	Rotek Heat Code
ROUGH RINGS A2060A12 59.560 51.750 X 5.120)	10	Z206
Heat No. H9944	Material Vendor ELLWOOD QUALITY STEELS	

CHEMICAL ANALYSIS

C	MN	P	S	SI	NI	CR	MO	CU	V	CB
.410	.740	.009	.013	.240	1.760	.850	.260	.150	.006	.003

MECHANICAL PROPERTIES OF TEST RING

B	TENSILE STRENGTH PSI	YIELD STRENGTH PSI	ELONG %	% RED. OF AREA	GRAIN SIZE
302	140,000	122,000	21	55	5

CLEANLINESS RATING PER E-45

A		B		C		D	
T	H	T	H	T	H	T	H
1.50	.00	.00	.00	.00	.00	1.50	.00

CHARPY IMPACT TEST RESULTS (FT. LBS.)

TEMP. °F.	#1	#2	#3
-4	66.0	60.0	60.0

ULTRASONIC INSPECTED

HEAT TREATMENT AUST. QUENCHED & TEMPERED

NOTES:

WE HEREBY CERTIFY THE ABOVE RESULTS ARE CORRECT AS REPORTED AND CONTAINED WITHIN COMPANY RECORDS.

Harry Friedman
AUTHORIZED SIGNATURE

CERTIFICATION OF TEST

CERTIFICATION NO. 526521 068022



ThyssenKrupp

C C	omer No.	Rotek Order No.	SPECIFICATION	Date
	FLO	M068022	AISI 4340 MOD. PER API-2C	2/25/01

S
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Part No.	PCS	Rotek Heat Code
ROUGH RINGS A2060A9 68.800 59.440 X 5.120)	8	Z228
Heat No. K1024	Material Vendor ELLWOOD QUALITY STEELS	

CHEMICAL ANALYSIS

C	MN	P	S	SI	NI	CR	MO	CU	V	CB
.430	.720	.010	.013	.260	1.750	.880	.250	.130	.005	.000

MECHANICAL PROPERTIES OF TEST RING

BHN	TENSILE STRENGTH PSI	YIELD STRENGTH PSI	ELONG %	% RED. OF AREA	GRAIN SIZE
302	139,000	120,000	20	59	5

CLEANLINESS RATING PER E-45

A		B		C		D	
T	H	T	H	T	H	T	H
1.00	.00	.00	.00	.00	.00	1.50	.00

CHARPY IMPACT TEST RESULTS (FT. LBS.)

TEMP.°F.	#1	#2	#3
-4	63.0	63.0	62.0

ULTRASONIC INSPECTED

HEAT TREATMENT AUST. QUENCHED & TEMPERED

NOTES:

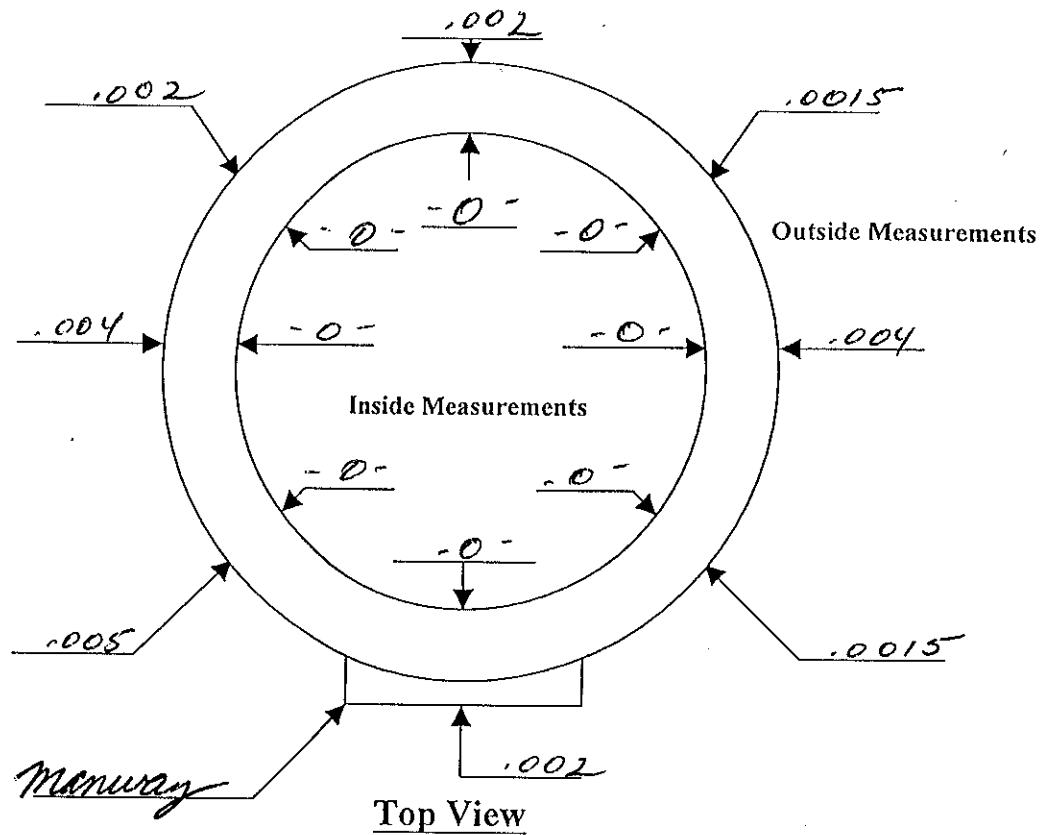
WE HEREBY CERTIFY THE ABOVE RESULTS ARE CORRECT AS REPORTED AND CONTAINED WITHIN COMPANY RECORDS.

Larry Friedman
AUTHORIZED SIGNATURE

BALLRING CLEARANCE REPORTS

NO.: NES194-037
REV.:
APPR: R.T.
DATE: 12/12/01

BALLRING TO PEDESTAL CLEARANCE REPORT



Weldment Serial Number: 02079-03

Weldment Part Number: N2002SK1-085

Crane Model Number: 180B-60

Crane Serial Number: 020209

Customer: Pernex

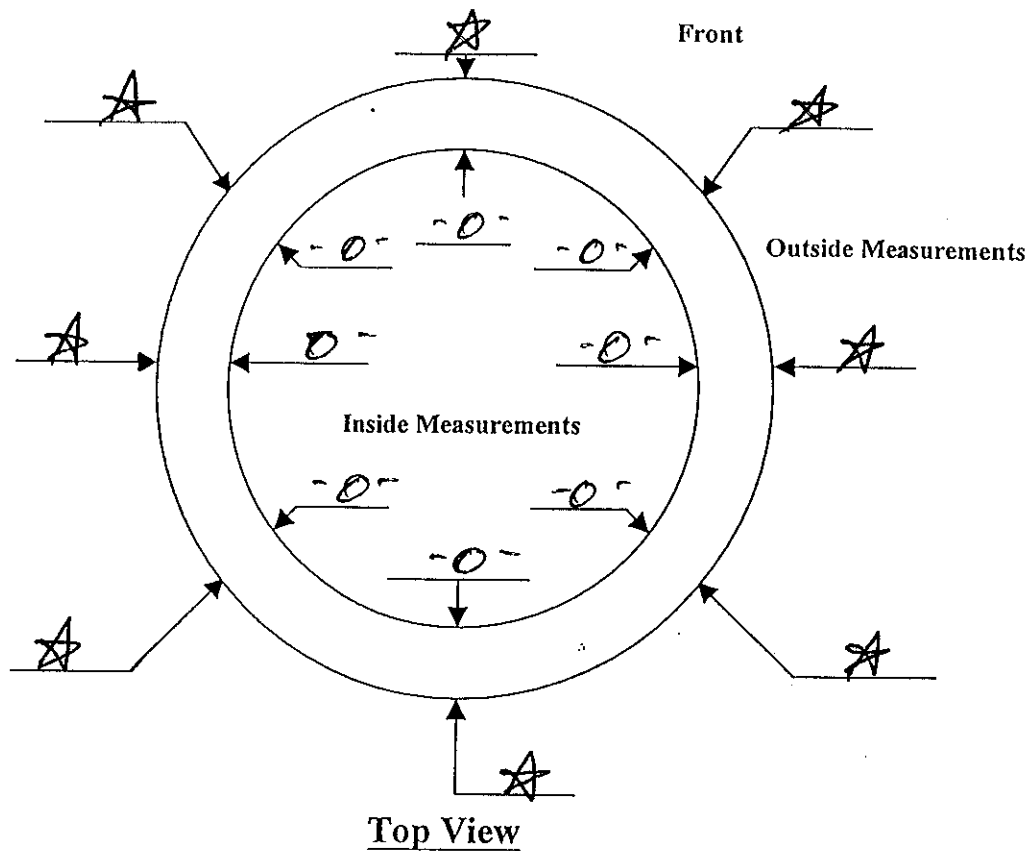
Remarks: All bolts fit, top
of flange parallel
with bottom

Inspector: Timothy Moller

Date Inspected: 4/10/02

NO.: NES194-038
REV.:
APPR: R-7
DATE: 12/12/01

BALLRING TO TURRET/UPPER STRUCTURE CLEARANCE REPORT



Weldment Serial Number: 02084-06

Weldment Part Number: N61933-002

Crane Model Number: 180B-60

Crane Serial Number: 020209

Customer: Pemex

Remarks: All bolts fit, all
machined holes are
within tolerances

Inspector: Kevin J. Mollen

Date Inspected: 5/23/02

BOLT CERTIFICATES



BOLTS, NUTS AND FASTENER PRODUCTS

LOT NO.1 0108-57582

FASTENER TEST REPORT

(THIS DOCUMENT MAY BE REPRODUCED, BUT ONLY IN ITS ENTIRETY)

10655

QUALITY BOLT & SCREW
9454 S CHOCTAW DR
BATON ROUGE, LA
70815-8995

I

PART NO.	DATE 2001-11-13
CUSTOMER P.O. NO.	REFERENCE NO.
INVOICE DATE	INVOICE NO.

DESCRIPTION AND MARKING
HEX HD CAP SCREW GR8 UNC YEL PL
SOLID TRIANGLE & 6 RADIAL LINES

SIZE

1-B X 3 1/2

GRADE

SAE 4042M6

QUANTITY

37,500

HEAT CHEMICAL ANALYSIS

HEAT NO.	C %	Mn %	P %	S %	SI %	CU %	MO %
C34859	0.43	0.80	0.013	0.014	0.23	0.10	0.220

MECHANICAL PROPERTIES (TESTED ACCORDING TO ASTM F606/606M) CORROSION RESISTANCE (ASTM B117)

SAMPLES SELECTED BY: 0700		PROOF LOAD (psi)	WEDGE TENSILE STRENGTH (psi)	SHEAR STRENGTH	SURFACE HARDNESS (R 30M)	CORE HARDNESS (ROCKWELL)
SPEC. MIN.		120,000	150,000		58.6	C 33.0
SPEC. MAX:						C 39.0
SAMPLE	NO. 1	120,000	159,000		56.4	C 34.9
	NO. 2		162,000		52.0	35.3
	NO. 3		163,000		55.8	36.6
	NO. 4		162,000		54.1	35.3
	NO. 5				56.2	34.7
	NO. 6				53.6	34.7
	NO. 7				55.8	35.1
	NO. 8				56.5	35.5

THE ABOVE TESTED SAMPLES HAVE BEEN INSPECTED FOR VISUAL DISCONTINUITIES AND FOUND ACCEPTABLE.
THEY COMPLY IN ALL RESPECTS WITH THE FOLLOWING SPECS:
SAE J-429, ASME B18.2.1, THREADS PER ASME B1.1 CLASS 2A UNLESS OTHERWISE
SPECIFIED. THESE FASTENERS WERE OIL QUENCHED AND TEMPERED AT A TEMP. ABOVE 800 °F
ASTM-B-633 TYPE II

Raw material used by Infasco to manufacture
contains no mercury and asbestos-free.
Fasteners were tested in the bare metal condition.

MANUFACTURED BY: INFASCO

Metallurgical Engineer

Gabriel Landry
Gabriel Landry



LOT NO.: 0108-57903

FASTENER TEST REPORT

(THIS DOCUMENT MAY BE REPRODUCED, BUT ONLY IN ITS ENTIRETY)

10655
QUALITY BOLT & SCREW
9454 S CHOCTAW DR
BATON ROUGE, LA
70815-8995

I

PART NO.	DATE 2001-11-13
CUSTOMER P.O. NO.	REFERENCE NO.
INVOICE DATE	INVOICE NO.

DESCRIPTION AND MARKING
HEX HD CAP SCREW GR8 UNC YEL PL
SOLID TRIANGLE & 6 RADIAL LINES

SIZE
5/8-11 X 3

GRADE
SAE 4042M

QUANTITY
105,400

HEAT CHEMICAL ANALYSIS

HEAT NO.	C %	Mn %	P %	S %	Si %	MO %
A54575	0.42	0.95	0.013	0.007	0.24	0.226

MECHANICAL PROPERTIES (TESTED ACCORDING TO ASTM F606/606M) CORROSION RESISTANCE (ASTM B117)

SAMPLES SELECTED BY: 0011	PROOF LOAD (psi)	WEDGE TENSILE STRENGTH (psi)	SHEAR STRENGTH	SURFACE HARDNESS (R 30M)	CORE HARDNESS (ROCKWELL)
SPEC. MIN.	120,000	150,000		58.6	C 33.0
SPEC. MAX:					C 39.0
SAMPLE NO. 1	120,000	163,000		56.6	C 34.9
NO. 2		165,000		56.8	36.2
NO. 3		164,000		56.2	36.0
NO. 4		171,000		55.8	35.8
NO. 5				55.9	35.4
NO. 6				55.3	35.6
NO. 7				55.5	35.1
NO. 8				54.6	35.0

THE ABOVE TESTED SAMPLES HAVE BEEN INSPECTED FOR VISUAL DISCONTINUITIES AND FOUND ACCEPTABLE.
THEY COMPLY IN ALL RESPECTS WITH THE FOLLOWING SPECS:
SAE J-429, ASME B10.2.1, THREADS PER ASME B1.1 CLASS 2A UNLESS OTHERWISE
SPECIFIED. THESE FASTENERS WERE OIL QUENCHED AND TEMPERED AT A TEMP. ABOVE 800 °F
ASTM-B-633 TYPE II

Raw material used by Infasco to manufacture
fasteners is mercury and asbestos-free.

Fasteners were tested in the bare metal condition.

MANUFACTURED BY: INFASCO

Metallurgical Engineer

Gabriel Landry
Gabriel Landry

Cardinal Fastener Test Certification

Reported:1/14/02

Certification No.:	10907	Shop Order#:	00198902
Order No.:	91908 5	Heat No.:	347439
Customer PO:	HMLA2283	Grade:	SAE J429
Customer No.:	000000039013	Thread Class:	2A
Customer:	FASTENAL HOUMA, LA	Shipped Qty:	913
Address:	858 HWY 182	Heat Treat Spec:	
	HOUMA, LA 70304	Supplier:	
		Finish Spec.:	
Manufacturer:	Cardinal Fastener & Specialty Co., Inc.	Supplier:	
Address:	5185 Richmond Road	Item description:	1 1/4 - 7 X 4 1/2 : GR8 HEX
	Bedford Heights, Ohio 44146	Headmark:	C/S CAD PLATE & CHARPY TEST
Laboratory:	Cardinal Fastener & Specialty Co., Inc.		
Address:	5185 Richmond Road		
	Bedford Heights, Ohio 44146		
Notes:			



Test No.:	18711	Order No.:	847439 0	Test Date:	12/8/01	Test Disposition:	PASS
Specification:	CHEM_GRADE 4142			Test Facility:	North Star		
Tech. Name:	Peter Shaver	Tech. Title:	Q.A. Tech	LotSize(pcs/lbs):	10000		
Notes:	Steel Mfg - North Star Steel Co			Sample Size:	1		
	Macro Etch Per ASTM E381 S2,R1,C2						

Inspection (min. - max.) units	Disposition	Sample Values:
CARBON (0.000) %	PASS	0.44
MANGANESE (0.000) %	PASS	0.91
PHOSPHORUS (0.000) %	PASS	0.014
SULFUR (0.000) %	PASS	0.016
SILICON (0.000) %	PASS	0.19
COPPER (0.000) %	PASS	0.24
NICKEL (0.000) %	PASS	0.1
CHROMIUM (0.000) %	PASS	0.94
MOLYBDENUM (0.000) %	PASS	0.17
ALUMINUM (0.000) %	PASS	0.003
VANADIUM (0.000) %	PASS	0.026

Test No.: 18597	Order No.: S47439 0	Test Date: 12/5/01 3:27:55	Test Disposition: PASS
Specification: CHEM_GRADE 4142		Test Facility: North Star Steel Co	
Tech. Name: Peter Shaver	Tech. Title: QA Tech	Lot Size(pcs/lbs): 10000	
Notes: Steel Mfg - North Star Minnesota 4142		Sample Size: 1	
MacroEtch Per ASTM E381 S2, R1, C2			

Inspection (min - max) units	Disposition	Sample Values:
CARBON (0, 999) %	PASS	0.44
MANGANESE (0, 999) %	PASS	0.91
PHOSPHORUS (0, 999) %	PASS	0.014
SULFUR (0, 999) %	PASS	0.016
SILICON (0, 999) %	PASS	0.19
COPPER (0, 999) %	PASS	0.24
NICKEL (0, 999) %	PASS	0.1
CHROMIUM (0, 999) %	PASS	0.94
MOLYBDENUM (0, 999) %	PASS	0.17
ALUMINUM (0, 999) %	PASS	0.009
VANADIUM (0, 999) %	PASS	0.026


Cert No: 10973

ALL MANUFACTURING AND MATERIAL PROCESSES IN THIS PRODUCT HAVE OCCURED WITHIN THE U.S.A. IN COMPLIANCE WITH THE BUY AMERICA PROVISIONS OF THE SURFACE TRANSPORTATION ACT OF 1982

All data represented on this report relates only to the item(s) tested, which have been sampled in order to represent the processed lot identified in the description.

Information and data in the report is correct and reliable to the best of our knowledge; however, results are not guaranteed and no responsibility is assumed.

All items furnished on the above referenced Purchase Order are in full conformance with all Purchase Order and Specification Requirements. Test values, either provided by our supplier or generated in Cardinal's Laboratory, represent actual attributes of the items furnished and the test results are in full compliance with all applicable specification and order requirements. All manufacturing, testing, sampling and inspections have been performed in accordance with Cardinal's Quality Assurance Program. All applicable tests are in accordance with the Quality Control Manual dated 4/24/98. The product was manufactured and supplied free from mercury contamination. This document may only be reproduced unaltered and only for the purpose of certifying the same or lesser quality of the product specified herein. Reproduction or alteration of this document for any other purpose is prohibited.



(Approval)

Q.A. Manager

(Title)

1/14/02

(Date Approved)

WIRE ROPE CERTIFICATES

Bethlehem Wire Rope ®

Certificate

of
Examination and Test of Bethlehem Wire Rope ®
Before Being Taken Into Use

4/8/02
APPLIED HYDRAULIC SYSTEMS
PO#064420
SO#139308
1 LENGTH OF 930'

Reel No 1051406

This Certificate when properly executed by a competent person, in accordance with 29CFR 1919.37, is accepted by the Government of the United States of America as being in accordance with the requirements of 29CFR 1918.12 and 1919.33.

Name and address of maker or supplier of Bethlehem Wire Rope ®



Williamsport Wire Rope Works, Inc.
PO Box 3188
Williamsport, PA 17701

Date Tested: Wednesday, January 02, 2002

Actual Break Strength In Pounds: 45,600

Description: 5/8 1919 BR BEI NR IW D

Size: 5/8 (In inches, unless otherwise specified)

Number of Strands: 19 Number of Wires per Strand: 19

Finish: Bright (Uncoated)

Grade: Extra Extra Improved Plow

Lay: Rotation Resistant

Core: Wire Rope

Design load, subject to any stated qualifying conditions such as minimum pulley diameter, direct tensile load, etc.:
"Using a design factor of 5 the design working load would be one-fifth of the rated catalog breaking strength."

Name and address of public service, association, company, or firm making the examination and test:

Williamsport Wire Rope Works, Inc.
100 Maynard Street
Williamsport, PA 17701

Position of signatory in public service, association, company, or firm making the examination and test:

Manager of Technical Services

I certify that the above particulars are correct and that the examination and test were carried out by a competent person.

Certificate No.: 002731

Signature:

per authority of

Dennis J. Weaver

Manager of Technical Services

Date: 1/3/02

In substantial agreement with I.L.O. Form No. 5
a GlobalIFT Technologies company

Certificate

of
Examination and Test of Bethlehem Wire Rope ®
Before Being Taken Into Use

4/8/02
APPLIED HYDRAULIC SYSTEMS
PO#064420
SO#139308
1 LENGTH OF 297'

Reel No 2051571

This Certificate when properly executed by a competent person, in accordance with 29CFR 1919.37, is accepted by the Government of the United States of America as being in accordance with the requirements of 29CFR 1918.12 and 1919.33.

Name and address of maker or supplier of Bethlehem Wire Rope ®



Williamsport Wire Rope Works, Inc.
PO Box 3188
Williamsport, PA 17701

Date Tested: Wednesday, January 16, 2002

Actual Break Strength in Pounds: 31,700

Description: 1/2 1919 BR EEI NR IW D

Size: 1/2 (In inches, unless otherwise specified)

Number of Strands: 19 Number of Wires per Strand: 19

Finish: Bright (Uncoated)

Grade: Extra Extra Improved Plow

Lay: Rotation Resistant

Core: Wire Rope

Design load, subject to any stated qualifying conditions such as minimum pulley diameter, direct tensile load, etc. :
"Using a design factor of 5 the design working load would be one-fifth of the rated catalog breaking strength."

Name and address of public service, association, company, or firm making the examination and test:

Williamsport Wire Rope Works, Inc.
100 Maynard Street
Williamsport, PA 17701

Position of signatory in public service, association, company, or firm making the examination and test:

Manager of Technical Services

I certify that the above particulars are correct and that the examination and test were carried out by a competent person.

Certificate No. : 002805

Signature:

per authority of

Dennis J. Weaver

Manager of Technical Services

Date: 1/17/02

In substantial agreement with LL.O. Form No. 5

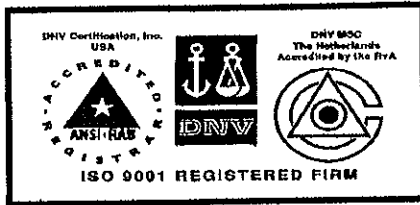
a Global Lift Technologies company

LOAD BLOCK CERTIFICATES

McKISSICK® P.O. BOX 3128 TULSA, OK. 74101

the Crosby group, inc.®

TELEPHONE 918/834-4611
TELEX 262569 CRSBY UR
FAX 918/834-9447



APPLIED HYDRAULIC SYSTEMS, INC.

SERIAL NO:
02-575-84
Thru
02-575-86

CROSBY PART NO: 8011196

CG NUMBER: 311417 Line 1

CUSTOMER PO#: 64075

JOB #: 020207-020208-020209

DESCRIPTION:

M030D14H 14" 30 TON
API 2C CRANE BLOCK
W/.625" WIRE LINE

Products of uncompromising quality . . .

CROSBY Clips & Fittings, LEBUS Load Binders, McKISSICK Blocks & Sheaves, CROSBY- WESTERN Blocks, NATIONAL Swaging Systems

*Plants and facilities in: Jacksonville, Arkansas - Los Angeles, California - Atlanta, Georgia - Chicago, Illinois - Tulsa, Oklahoma - Harrisburg, Pennsylvania
Dallas, Texas - Longview, Texas - Seattle, Washington - Toronto (Brampton), Ontario - Barnsley, England - Mechelen (Putte), Belgium - Cergy St. Christophe, France*

080005.03 1
Regular Order Discounted Order-
Customer No. 2980 Order Number 311417
APPLIED HYDRAULIC SYSTEMS, INC

Order Inquiry 9:24:16 CROSBY
4 % Entered By DOUG 4/11/02
Last maintained by 0/00/00
APPLIED HYDRAULIC SYSTEMS, INC

POX 10155, STA 1
UMA

204 INDUSTRIAL AVE C
HOUMA

LA

LA

70363

70363

Customer PO # Ship Via SCHEDULE Order Date Ship-to PO # Whse SR DR
64075 3/19/02 3/19/02 MK 52 - 12

Inv#: Ship: Frt Amt: Pick: Shipv:
Inv Date: 0/00/00 Frt Code: 1 Ship Info.: 0000000 01

Line Qty Qty Invoice Priority: 1
Ordered Allocat. Prod. # WH U Sts Ctlg and Description Sell Price

1 3 0 8011196 MK ENT 382 CRANE BLK 5/8L SP

SE YELLOW

HB YELLOW

LA YELLOW

CH AM FRT

LV SAIA

MK SAIA

Records to Roll (1-24): 8 Total Weight
F1=End F3=Fold F6=New Inquiry

1920.00 Order Total:

F24=More keys

APPLIED HYDRAULIC SYSTEMS
BOX 10155, STA 1
HOUMA, LA 70363

the Crosby[®] group, inc.

Certificate Form No. 311417

Customer Purchase Order No. 64075

Crosby Group Order No. 311417

**CERTIFICATE OF CONFORMANCE OF CHAINS, RINGS, HOOKS, SHACKLES,
SWIVELS AND PULLEY BLOCKS**

(1) Distinguishing number or mark (if any)	(2) Description of gear	(3) Number	(4) Date	(5) Working Load Limit
SERIAL NO. 02-575-84 Thru 02-575-86 PART NO. 8011196	M030D14H 14" 30 TON API 2C CRANE BLOCK W/.625" WIRE LINE PICS: TRUNNION - BHBC PIN - BBCK PLATE DE-ADAPTER - ZHBD SERIAL NO: HOOK: SIDE PLATES: 02-575-84 5BK BHBH 02-575-85 5BK CHBF 02-575-86 5BB CHBF	3	04/22/02	60,000 Lbs

(7) Name and address of makers or suppliers The Crosby Group / McKissick Products

2801 Dawson Road, Tulsa, Ok 74110-5040 U.S.A.

(8) Name and address of public service, association, company or firm making the test and examination _____

SAME

(9) Position of signatory in public service, association, company or firm _____

QUALITY ASSURANCE MANAGER

We hereby certify that the above described material was manufactured and processed in a manner compatible to meeting the specified load ratings when used under normal and proper applications.

April 23, 2002

(Date) _____ (Signature) Robert Shuman

ROBERT SHUMAN

Tensile Test Data Sheet
QCP 1400

Lab Log Number: L-01-71

Description: 19-A-30-5BB

Die Number: 695

Specifications: ASTM Class AE (521-76(92) Or K (668-93)

Specimen Size:

0.505 Inches Diameter

Specimen Area:

0.2 Square Inches

Elongation:

16 %

Reduction Of Area:

49 %

Tensile Strength:

127.3 KSI

Tensile Load:

25,460 LBS.

Yield Strength:

86.4 KSI

Yield Load:

17,280 LBS.

Hardness:

285 BHN

Hardness @ Surface Of Tensile Bar:

248 BHN

Exceptions:

Elongation & R.O.A.

Test performed by MidStates Analytical Laboratories, Inc.

Prepared By: Janell Barthelme



Approved By: James E. Fryar



16Feb01 15:

TEST CERTIFICATE

P/O No P53043

Rel

S/O No 1 78137-001

B/L No 1 53211-001 Shp 15Feb01

Inv No Inv

KREHER STEEL COMPANY, LLC

812 LEXINGTON, STE. #100, PLANO, TEXAS 75075
 (972) 878-8118
 (972) 825-7814
 FAX (972) 423-4460

Sold To: (376)
 CROSBY-LEBUS MFG.
 P.O. BOX 271
 LONGVIEW, TX 75606

Ship To: (001)
 CROSBY-LEBUS MFG.
 900 FISHER ROAD
 LONGVIEW, TX 75606

Tel: 903-759-4424 Fax: 903-759-4499

CERTIFICATE of ANALYSIS and TESTS

Cert. No: 1

43336

16Feb01

Part No
 HOT ROLLED ROUNDS 8630
 3.6250 X 20'

Heat Number
 0100160

*** Chemical Analysis ***

C=<.29> Mn=<.83> P=<.012> S=<.020> Si=<.25> Cu=<.16> Ni=<.43>
 Cr=<.52> Mo=<.18> Al=<.028> V=<.002> Sn=<.015> Cb=<.001>
 Ti=<.002> Gr=<F>

*** Jominy Tests ***

1=	2=	3=	4=	5=	6=	7=	8=
9=	10=	12=	14=	16=	18=	20=	24=
28=	32=						

C=<.29> Mn=<.81> P=<.007> S=<.002> Si=<.24> Cu=<.11> Ni=<.51>
 Cr=<.54> Mo=<.21> Al=<.034> V=<.003> Sn=<.008> Cb=<.002>
 Ti=<.001> GR=<7>

*** Jominy Tests ***

1=	2=	3=	4=	5=	6=	7=	8=
9=	10=	12=	14=	16=	18=	20=	24=
28=	32=						

I hereby certify that this data is correct as
 contained in the records of this company.

M. Potter

LABORATORY REPORT

Attn: Bucky Weaver
The Crosby Group, Inc.
P.O. Box 3128
Tulsa, OK 74101

Report No: 2001060771
Date Received: 06/28/2001
Date Reported: 06/30/2001
P.O. No: M0104336

Description: P/N 2008040 PIC 5BB, 319-A 30 Ton Hook API 2C, WO #247570 P/N 2008040

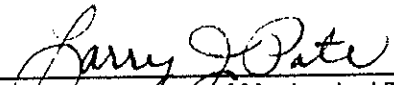
Room Temperature Tensile Test (ASTM E 8-98)

<u>Parameter</u>	<u>Result</u>
Diameter, in.	0.501
Tensile Strength, psi	124,800
Yield Strength, psi by 0.2% offset	101,200
Elongation in 2", %	18
Reduction of Area, %	63

Hardness, ASTM E 18-97a

Location	Result
4/5 Radius	HRC 26.5, 27.0, 27.0

Approved by: _____


Larry Pate, Manager of Mechanical Testing
Sherry Laboratories Midstates



SHERRY Laboratories

Testing Today -- Protecting Tomorrow™

Materials Testing
3100 N. Hemlock Circle
Broken Arrow, OK 74012

Tel: (918) 258-6066
(800) 324-8378
Fax: (918) 258-1154

LABORATORY REPORT

Attn: Bucky Weaver
The Crosby Group, Inc.
P.O. Box 3128
Tulsa, OK 74101

Report No: 2001060771
Date Received: 06/28/2001
Date Reported: 06/30/2001
P.O. No: M0104336

Description: P/N 2008040 PIC 5BB, 319-A 30 Ton Hook API 2C, WO #247570 P/N 2008040

Impact Test Report

Style and Model of Machine: Tinius-Olsen, 74
Available Impact Energy: 264 Ft-Lbs.
Impact Velocity: 17 Ft/Sec.
Method of Test: SA-370/ASTM-E23
Specimen Type: Charpy "V" Notch
Specimen Location: ASTM-A370 Longitudinal
Notch Orientation: Perpendicular to Surface
Specimen Size: 10mm X 10mm
Test Temperature: -40 °F

Notch Location:	Base
Impact Values (Ft-Lbs.):	41, 46, 27
Lateral Expansion (Mils):	25, 29, 17
Shear (%):	40, 45, 30

Approved by: _____

Larry J. Pate
Larry Pate, Manager of Mechanical Testing
Sherry Laboratories Midstates

Test results relate only to the items tested. This document shall not be reproduced, except in full, without the written approval of Sherry Laboratories Midstates. The recording of false, fictitious, or fraudulent statements or entries on this document may be a punishable offense under federal and state law.

THE CROSBY GROUP - TULSA
TENSILE TEST DATA SHEET

DATE: 10/26/01 SERVICE QCP 1400 LAB LOG NO. L-01-239
DESCRIPTION: 19-A-30-5BK DIE NO. 695
SPECIFICATIONS: ASTM CLASS AE (521-76(92) OR K (668-93)

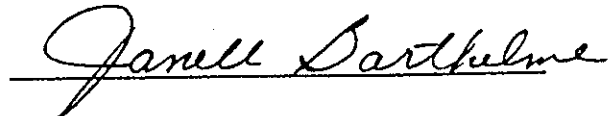
SPECIMEN SIZE: 0.505 INCHES DIAMETER
SPECIMEN AREA: 0.2 SQUARE INCHES
ELONGATION: 18 %
REDUCTION OF AREA: 57 %
TENSILE STRENGTH: 120.1 KSI
TENSILE LOAD: 24,020 LBS
YIELD STRENGTH: 96.9 KSI
YIELD LOAD: 19,380 LBS
HARDNESS: BHN 269

SURFACE OF TENSILE BAR: BHN 248

EXCEPTIONS: ELONGATION

TESTS PERFORMED BY MIDSTATES ANALYTICAL LABORATORIES, INC.

PREPARED BY: JANELL BARTHELME



APPROVED BY: JAMES E. FRYAR



01May01 9:10

T E S T C E R T I F I C A T E

No: 1 44900

P/O No 78137

Rel

S/O No 1 83168-001

B/L No

Inv No

Shp
Inv

KREHER STEEL COMPANY, LLC

Sold To: (376)
CROSBY-LEBUS MFG.
P.O. BOX 271
LONGVIEW, TX 75606

Ship To: (001)
CROSBY-LEBUS MFG.
900 FISHER ROAD
LONGVIEW, TX 75606

Tel: 903-759-4424 Fax: 903-759-4499

CERTIFICATE of ANALYSIS and TESTSCert. No: 1 44900
01May01

Part No
HOT ROLLED ROUNDS 8630
3.6250 X 20'

0

EDP# 92741

Heat Number
E55103

*** Chemical Analysis ***

C=<.33> Mn=<.84> P=<.010> S=<.019> Si=<.22> Cu=<.27> Ni=<.48>
Cr=<.49> Mo=<.19> Sn=<.012> V=<.049> GR=<7>

*** Jominy Tests ***

1=	2=	3=	4=	5=	6=	7=	8=
9=	10=	12=	14=	16=	18=	20=	24=
28=	32=						

I hereby certify that this data is correct as
contained in the records of this company.

Carol Kepca

**SHERRY**Laboratories

Testing Today - Protecting Tomorrow

Materials Testing
3100 N. Hemlock Circle
Broken Arrow, OK 74012

Tel: (918) 258-6066

(800) 324-8378

Fax: (918) 258-1154

LABORATORY REPORTAttn: Bucky Weaver
The Crosby Group, Inc.
P.O. Box 3128
Tulsa, OK 74101Report No: 2002020306
Date Received: 02/13/2002
Date Reported: 02/18/2002
P.O. No: M0200993

Description: Pic Code-5BK, Hook 319-A 30 Ton API 2C, WO #255775, P/N: 2008040


Room Temperature Tensile Test (ASTM E 8-2000)

<u>Parameter</u>	<u>Result</u>
Diameter, in.	0.5065
Tensile Strength, psi	135,800
Yield Strength, psi by 0.2% offset	115,900
Elongation in 2", %	17
Reduction of Area, %	59

Hardness, ASTM E 18-97a

Location	Result
4/5 RADIUS	HRC 28.0, 28.5, 29.5

Approved by:


Larry Pate, Manager of Mechanical Testing
Sherry Laboratories

Test results relate only to the items tested. This document shall not be reproduced, except in full, without the written approval of Sherry Laboratories. The recording of false, fictitious, or fraudulent statements or entries on this document may be a punishable offense under federal and state law.

**SHERRY**Laboratories

Testing Today - Protecting Tomorrow

Materials Testing
3100 N. Hemlock Circle
Broken Arrow, OK 74012Tel: (918) 258-6066
(800) 324-8378
Fax: (918) 258-1154**LABORATORY REPORT**Attn: Bucky Weaver
The Crosby Group, Inc.
P.O. Box 3128
Tulsa, OK 74101Report No: 2002020306
Date Received: 02/13/2002
Date Reported: 02/18/2002
P.O. No: M0200993

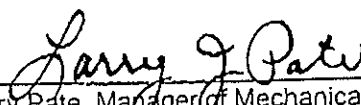
Description: Pic Code-5BK, Hook 319-A 30 Ton API 2C, WO #255775, P/N: 2008040

Impact Test, ASTM A370/ASTM E23Test Machine Capacity: 300 Ft-Lbs.
Specimen Type: Charpy "V" Notch
Specimen Location: ASTM-A370 Longitudinal
Notch Orientation: Perpendicular to Surface
Specimen Size: 10mm X 10mm
Test Temperature: -40 °F

Notch Location:	Base
Impact Values (Ft-Lbs.):	25, 29, 24
Lateral Expansion(Mils):	13, 15, 12
Shear(%):	25, 30, 25

Absorbed energy values above 80% of the scale range are approximate.

Approved by:


Larry Pate, Manager of Mechanical Testing
Sherry Laboratories

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OREGON STEEL MILLS

P.O. BOX 2780, Portland, Oregon 97208 • (503) 286-9651 Fax (503) 240-5268



UNI-STEEL INCORPORATION
YAFFE STEEL DIVISION
PO BOX 3528
ENID, OK 93707-3528

REPORT OF CHEMICAL/PHYSICAL TESTS

UNI-STEEL INCORPORATION
YAFFE STEEL DIVISION
ATTN:HAZEL HICKLE
PO BOX 3528
ENID, OK 93707-3528

CERTIFICATE NO	DATE	PAGE
414818P	AUG 19, 1996	1
MILL ORDER NO	DATE	
65061		
CUSTOMER ORDER NO		
25407		
ORDER NO.		
SHIPPING NO	DATE	
414818	08/19/1996	
CARRIER		
UNION PACIFIC		
CARTRUCK NO		
CR158566		

THIS MATERIAL HAS BEEN MANUFACTURED, TESTED AND FOUND TO MEET THE SPECIFICATIONS AND PURCHASE ORDER REQUIREMENTS
OSM CARBON PRESSURE VESSEL QUALITY ASTM A516-90 GRADE 70 ASME SA516 GRADE 70
1992/1994 ADDENDA NORMALIZED. NORMALIZE. LCVN 25 FT/LBS AVG @ -25 F (P) 22
FT/LBS MIN.

PHYSICAL PROPERTIES

HEAT NO.	SLAB	YIELD PSI X 100	TENSILE PSI X 100	% ELONG 8" 2"	% RA	HARDNESS BHN	BEND TEST	IMPACTS
1 3.5000 X 96.000 X 213.000								
THE FOLLOWING PLATES AND TESTS WERE NORMALIZED AT 1680 DEGS F FOR 175 MINUTES AND AIR COOLED								
1 PC 20297 LBS	X00004 A38	448	740	29				
THE FOLLOWING PLATES AND TESTS WERE NORMALIZED AT 1680 DEGS F FOR 176 MINUTES AND AIR COOLED								
1 PC 20297 LBS	X00022 A35	443	745	30				
2 PCS 40594 LBS TOTALS								

Thunnon: BHBC

MILL TEST REPORTS FURNISHED
BY UNI-STEEL, INC.
DATE 7-26-01

CHEMICAL ANALYSIS

HEAT NO.	C	Mn	P	S	Si	SH	CU	NI	V	CO	AL	CR	MO	N	B	TI	AS
X00004	.23	1.13	.020	.013	.27	.02	.03	.03	<.01	<.008	.051	.03	.01				
X00022	.23	1.13	.016	.009	.28	.02	.02	.02	<.01	<.002	.046	.02	.01				
ALL HEATS INDICATED WITH (+) WERE MELTED AND MANUFACTURED IN THE USA.																	
END OF REPORT																	

CUSTOMER	CR158566
CUSTOMER ORDER NO	25407
CUSTOMER PART #	2008048
HEAT #	X00022
PCS	2
DATE	AUG 1996

I certify the above to be correct as contained in the records of OREGON STEEL MILLS BY Susan M. Yaffe O.C. RECORDS
ADMINISTRATOR

Metallurgical
Test Report

(USS)

08/20/99 MS-41241

H07041 02 17 25 UB64412

MS MP 819640

CALY WORKS
GARY, INDIANA 46402

** MELTED AND MANUFACTURED IN THE USA **
UNI STEEL INC

YAFFE STEEL DIV
C/O JOHNSTON TERMINAL
PORT OF MUSKOGEE OK
MUSKOGEE OK 74401

UNI-STEEL INC
YAFFE STEEL DIV
P O BOX 3528
ENID OK 73702-3528

YAFFE STEEL DIV
C/O JOHNSTON TERMINAL
PORT OF MUSKOGEE OK
MUSKOGEE OK 74401

PREPARED BY THE OFFICE OF:
S.C. PAPE GEN. MGR, Q.A.

9-23-99

Date

PLATE CARBON ASTM A516-90 GRADE 70 ASME SA516-1998 EDITION,
JULY 1, 1998 GRADE 70 PRESSURE VESSEL QUALITY NORMALIZE REST
FLATNESS TOL 1/2 STD CHARPY V-NOTCH LONGITUDINAL IMPACT TESTS
EACH PLATE AS ROLLED 15/12 FT/LBS AT -50 DEG F
INSP: 01 MILL RA/SN CERTIFIED T/R ANALYSIS 3 ORIGINALS TO SLD ATTN JEFF
CRABTREE FAX 1 COPY TO JEFF CRABTREE @ 580-233-1342 IN COMPLIANCE
WITH STATEMENT DIN 50049 PAR 3.1.B MELTED AND MFG IN THE USA

"BHBH"

P/N 2008033

Side Plate

HT# D83753

Item No	Thickness of Section	Width, Dia. of Fl. Wt.	Length	Quantity	Weight	Heat No	Tem or Pect Identfy	Yield KSI	Tensile KSI	Elongation %		% Red of Area	Band
										in 2"	in 2"		
01	3/4"	96.0000	480"	01	9801	D83753	55Y 3	54.0	75.0	28.0	49.0		
STEEL-TYPE = CAST REDUCTION RATIO = 12.1 TO 1 LONG. FL SZ CHARPY IMPFT V-NTCH -050 DEG F FT LBS/ 032-038-038 -46 DEG C AVERAGE IMPACT STRENGTH +36 FT LBS PRODUCT & TEST SPECIMENS WERE NORMALIZED AT 1660 DEG. F. FOR 0042 MINUTES. COOLING COMPLETED IN STILL AIR.													
01	3/4"	96.0000	480"	01	9801	D83753	54X 1	53.0	75.0	24.0	42.0		
STEEL-TYPE = CAST REDUCTION RATIO = 12.1 TO 1													

*YIELD STRENGTH @ 0.5% E.U.L.

THIS REPORT SHALL NOT BE REPRODUCED WITHOUT THE PRIOR WRITTEN APPROVAL OF THE USX CORPORATION.

FINE GRAIN

Heat No

D83753

HEAT 22 097 013 008 20 02

END OF DATA

ALL TEST RESULTS WERE CONDUCTED AND RECORDED IN ACCORDANCE WITH TEST METHODS ACCREDITED BY A2LA

Decimal Positions For Elements Are Indicated By The Left Margin, Vertical Dotted Line Or Decimal Point

990917 MV21 0959 700143010 091799

GMS

9705750005 01

9705750005 01

9705750005 01

9705750005 01

01 000 0072 REV 2

01 000 0072 REV 2

01 000 0072 REV 2

01 000 0072 REV 2

01 000 0072 REV 2

01 000 0072 REV 2

01 000 0072 REV 2

01 000 0072 REV 2



CENTER PIN
HEAT: 8990651

PIC: BBCK
P/N 2009981

CERTIFICATE OF TEST

Page 01 of 01

Certification Date
7-MAR-2001

CUSTOMER ORDER NUMBER

M-0101610/2009981

3116 E. 31ST STREET NORTH
TULSA OK 74110

Invoice Number
S462604

CUSTOMER PART NUMBER

2009981

SOLD TO: MCKISSICK PRODUCTS CO
P O BOX 3128
TULSA OK 741013128

SHIP TO: MCKISSICK PRODUCTS CO
2801 DAWSON RD GATE 5
TULSA OK 74110

Description: 8620 COLD FINISH ASTM A331
2-3/4 RD X 12' R/L
HEAT: 8990651

ITEM: 506966

Line Total: 727.6 LB

Specifications:
ASTM A331 95

CHEMICAL ANALYSIS

C	MN	P	S	SI	CU	NI	CR
0.18	0.8	0.008	0.025	0.18	0.1	0.42	0.52
AL	V	N	CB	SN	MO		
0.023	0.002	0.0078	0.002	0.006	0.16		

RCPT: R 5745
MILL : REPUBLIC TECHNOLOGIES INTERNTL COUNTRY OF ORIGIN : USA
END-QUENCH HARDENABILITY (JOMINY - RC) IN
1 2 3 4 5 6 7 8
44 41 33 27 24 22 21 20

GRAIN SIZE : 7 -

MATERIAL IS FREE FROM MERCURY CONTAMINATION
NO WELD REPAIR PERFORMED ON MATERIAL

COMMENTS

MELT SOURCE RTI
MELT COUNTRY USA
HOT ROLL SRCE RTI
HOT ROLL COUNTRY USA
BLOOM CAST RED RATIO TO 1 20.9

The above data were transcribed from the manufacturer's Certificate of Test after verification for completeness and specification requirements of the information on the certificate. All test results remain on file subject to examination.

We hereby certify that the material covered by this report will meet the applicable requirements prescribed herein, including any specification forming a part of the description.

The willful recording of false, fictitious, or fraudulent statements in connection with test results may be punishable as a felony under federal statutes.

Material did not come in contact with mercury while in our possession.

KAREN NEWCOMB

Karen Newcomb
MANAGER, QUALITY ASSURANCE



SHERRYLaboratories

Testing Today - Protecting Tomorrow™

Materials Testing
3100 N. Hemlock Circle
Broken Arrow, OK 74012

Tel: (918) 258-6066
(800) 324-8378
Fax: (918) 258-1154

LABORATORY REPORT

Attn: Bucky Weaver
The Crosby Group, Inc.
P.O. Box 3128
Tulsa, OK 74101

Report No: 2001030666
Date Received: 03/21/2001
Date Reported: 03/23/2001
P.O. No: M0102032

Description: Pic Code-BBCK, 2 1/2" Diameter Special bar API 2C, WO# 243418, P/N 2008036

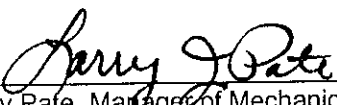
Room Temperature Tensile Test (ASTM E 8-98), Longitudinal

<u>Parameter</u>	<u>Result</u>
Diameter, in.	0.5015
Tensile Strength, psi	103,800
Yield Strength, psi by 0.2% offset	68,600
Elongation in 2", %	16
Reduction of Area, %	42

Hardness, ASTM E 18-97a

Location	Result
4/5 RADIUS	HRB 95.5, 96.5, 96.0

Approved by: _____


Larry Pate, Manager of Mechanical Testing
Sherry Laboratories

Test results relate only to the items tested. This document shall not be reproduced, except in full, without the written approval of Sherry Laboratories Midstates. The recording of false, fictitious, or fraudulent statements or entries on this document may be a punishable offense under federal and state law.

Materials Testing
3100 N. Hemlock Circle
Broken Arrow, OK 74012



Tel: (918) 258-6066
(800) 324-8378
Fax: (918) 258-1154

LABORATORY REPORT

Attn: Bucky Weaver
The Crosby Group, Inc.
P.O. Box 3128
Tulsa, OK 74101

Report No: 2001030666
Date Received: 03/21/2001
Date Reported: 03/23/2001
P.O. No: M0102032

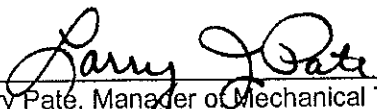
Description: Pic Code-BBCK, 2 1/2" Diameter Special bar API 2C, WO# 243418, P/N 2008036

Impact Test Report

Style and Model of Machine: Tinius-Olsen, 74
Available Impact Energy: 264 Ft-Lbs.
Impact Velocity: 17 Ft/Sec.
Method of Test: SA-370/ASTM-E23
Specimen Type: Charpy "V" Notch
Specimen Location: ASTM-A370 Longitudinal
Notch Orientation: Perpendicular to Surface
Specimen Size: 10mm X 10mm
Test Temperature: -25 °F

Notch Location:	Base
Impact Values (Ft-Lbs.):	14, 12, 18
Lateral Expansion(Mils):	13, 11, 16
Shear(%):	20, 20, 20

Approved by:


Larry Pate, Manager of Mechanical Testing
Sherry Laboratories

Test results relate only to the items tested. This document shall not be reproduced, except in full, without the written approval of Sherry Laboratories Midstates. The recording of false, fictitious, or fraudulent statements or entries on this document may be a punishable offense under federal and state law.

Test Report

THIS IS TO CERTIFY THAT THE PRODUCT DESCRIBED HEREIN WAS MFGD., SAMPLED, TESTED AND/OR INSPECTED IN ACCORDANCE WITH THE SPECIFICATION AND FULFILLS REQUIREMENTS IN SUCH RESPECT.

PREPARED BY THE OFFICE OF:
S.C. PAPE GEN. MGR, Q.A.

Dec 6-29-99

Order No. **06/02/99** **008-40048**
 Ship Date **06/26/99** **08B3615**
 Invoice No. **154-062489**
 Order No. **08B3615**
 Invoice No. **154-062489**
 Order No. **08B3615**
 Invoice No. **154-062489**
 Order No. **08B3615**
 Invoice No. **154-062489**

PLATE CARBON ASTM A516-90 GRADE 70 ASME SA516-1998 EDITION, JULY 1, 1998 GRADE 70 PRESSURE VESSEL QUALITY NORMALIZE REST, FLATNESS TOL 1/2 STD CHARPY V-NOTCH LONGITUDINAL IMPACT TEST EACH PLATE AS ROLLED 15/12 FT/LBS AT -50 DEG F

INSPECTION MILL, RA/SN CERTIFIED T/R ANALYSIS 3 ORIGINALS TO SLD TO ATTN HAZEL KAMPSCROEDER FAX ONE COPY TO JEFF CRABTREE AT 508-233-1342 DIN 50049 PAR 3.1.B COMPLIANCE STATEMENT REQUIRED ON TESTS-MELTED

Spec. & Insp.	Material Description	Width, Dia. or R. Wt.	Length	Quantity	Weight	Heat No.	Test or Place Made	Yield Pt.	Tensile St.	Elongation % in 8"	Red. of Area	Doc.
1	THE MATERIAL COMPLIES WITH DIN 50049 PARA 3.1 "B" ***END OF DATA***						MILL TEST REPORTS FURNISHED BY UNI-STEEL, INC. DATE 1-17-00 CUSTOMER M. Kessich CUSTOMER P.O. # 11-0000086 CUSTOMER PART # 2008045 HEAT # E84124 PCS 1 PCS 1					

Type	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sb	As	N	V	Se	Fe	Co	Cr
END OF DATA																	

THIS REPORT SHALL NOT BE REPRODUCED WITHOUT THE PRIOR WRITTEN APPROVAL OF THE USX CORPORATION.

ALL TEST RESULTS WERE CONDUCTED AND RECORDED IN ACCORDANCE WITH TEST METHODS ACCREDITED BY A2LA

MATRIX 990626 MV21 0943 700143010 062699

9705750005 01 GMS

01.000.0712 REV. 100





Steel Group

A unit of USX Corporation

Test Report

PO Date	06/02/99	PO#	40048
Shopper No.	H06177	06 26 99	UB83615
Shopper No.	MP 819687		

GARY WORKS
GARY, INDIANA 46402

** MELTED AND MANUFACTURED IN THE USA **

UNI-STEEL INC
YAFFE STEEL DIV
P O BOX 3528
ENID OK 73702-3528UNI STEEL INC
YAFFE STEEL DIV
C/O JOHNSTON TERMINAL
PORT OF MUSKOGEE OK
MUSKOGEE OK 74401

JUL-01-1999 11:20

UNI-STEEL, INC.

P.05/16

THIS IS TO CERTIFY THAT THE
PRODUCT DESCRIBED HEREIN WAS
MFGD., SAMPLED, TESTED AND/C
INSPECTED IN ACCORDANCE WITH
THE SPECIFICATION AND FUL-
FILLS REQUIREMENTS IN SUCH
RESPECT.PREPARED BY THE OFFICE OF:
S.C. PAPE GEN. MGR, Q.A.

Ods

6-29-99

PLATE CARBON ASTM A516-90 GRADE 70 ASME SA516-1998 EDITION,
JULY 1, 1998 GRADE 70 PRESSURE VESSEL QUALITY NORMALIZE REST
FLATNESS TOL 1/2 STD CHARPY V-NOTCH LONGITUDINAL IMPACT TESTS
EACH PLATE AS ROLLED 15/12 FT/LBS AT -50 DEG FINSP: 01 MILL RA/SN CERTIFIED T/R ANALYSIS 3 ORIGINALS TO SLD TO ATTN
HAZEL KAMPSCHROEDER FAX ONE COPY TO JEFF CRABTREE AT 508-233-1342
DIN 50049 PAR 3.1.B COMPLIANCE STATEMENT REQUIRED ON TESTS-MELTED

Item No.	Material Description				Quantity	Weight	Heat No.	Test at Place Identify	Yield KSI	Tensile KSI	Elongation %		% Red. of Area	Spec
	Thickness or Section	Width, Dia. or R. WT.	Length								In 8"	In 2"		
08	1.0000	96.0000	240"		01	6534	E84124	56X 1						
	STEEL-TYPE = CAST		REDUCTION RATIO =	9.1 TO 1										
	LONG. FL SZ CHARPY IMPACT V-NOTCH -050 DEG F		FT LBS /	026-027-031										
08	1.0000	96.0000	240"		02	13068	E84124	56Y 1						
	STEEL-TYPE = CAST		REDUCTION RATIO =	9.1 TO 1										
	PRODUCT & TEST SPECIMENS WERE NORMALIZED AT 1660 DEG.F.													
08	1.0000	96.0000	240"		02	13068	E84124	56Y 1						
	STEEL-TYPE = CAST		REDUCTION RATIO =	9.1 TO 1										
	PRODUCT & TEST SPECIMENS WERE NORMALIZED AT 1660 DEG.F.													

*YIELD STRENGTH @ 0.5% E.U.L.

THIS REPORT SHALL NOT BE REPRODUCED WITHOUT THE PRIOR WRITTEN APPROVAL OF THE USX CORPORATION.

Heat No.	Type	C	Ma	P	S	Si	Cu	Mn	Cr	Mo	Sb	Ni	V	Fe	Co	Other	Grain
E84124	HEAT 22	095	016	012	20	33	01	03	00	025	001	001	001	001	001	001	FINE GRAIN
END OF DATA																	

ALL TEST RESULTS WERE CONDUCTED AND RECORDED IN ACCORDANCE WITH TEST METHODS ACCREDITED BY A2LA

MATRIX 990626 MV21 0943 700143010 062699 9705750005 01 GMS CHA 0 0 4 PAGE 5

CROSBY/McKISSICK PRODUCT
NUMBER: 2008033

DESCRIPTION/SPECIFICATIONS:
.75" A-516 PLATE PIC: PLATE—CHBF

CHEMICAL ANALYSIS

HEAT NO: 23663	C. .22	MN. 1.09	P .017	S .009	SI .27
	Cr .08	Mo .01	Ni .03	Cu .10	V .01
	Al .043	Nb .01			

PHYSICAL PROPERTIES
(P S I)

YIELD STRENGTH
54,000

ELON %
24

TENSILE STRENGTH
82,000

CHARPY "V" NOTCH
-50° F (FT-LBS)
43 - 45 - 39 - 42

THE ABOVE DATA WERE TRANSCRIBED FROM THE MANUFACTURER'S CERTIFICATE OF TEST AFTER A VERIFICATION FOR COMPLETENESS AND SPECIFICATION REQUIREMENTS OF THE INFORMATION ON THE CERTIFICATE. ALL TEST RESULTS REMAIN ON FILE SUBJECT TO EXAMINATION.

THE WILLFUL RECORDING OF FALSE, FICTITIOUS, OR FRAUDULENT STATEMENTS IN CONNECTION WITH TEST RESULTS MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTES.

Catherine Choate
QUALITY ASSURANCE ASSISTANT
CATHERINE CHOATE

INSPECTION CERTIFICATE, ABNAHMEPRÜFZEUGNIS, CERTIFICAT DE RÉCEPTION DU MATÉRIEL

ČSN EN 10204 3.1.b

L. No. 4769 Date 8.03.01 1

ORIGIN: 200 - PLOCHÉ VÝROBKÝ, 700 02 OSTRAVA 4 - ČESKÁ REPUBLIKA
DIVISION 200 - FLAT PRODUCTS, 700 02 OSTRAVA 4 - CZECH REPUBLIC
ORIGIN: 200 - PLAKES, 700 02 OSTRAVA 4 - REPUBLIC OF CZECHIA
DIVISION 200 - PRODUCTS PLATES, 700 02 OSTRAVA 4 - REPUBLIC OF CZECHIA

Zákazník: Customer: Bostler, Deschamps

Zákazník: Purchase Order No.
Detail: Nr. Commande: No.

151486-11
0111K30265/0007
10087 LOT VJAN5

Období: Delivery: Shop Order No.
Adresa: Nr. Order: No.

NORSTEEL CORPORATION
345 HUDSON STREET
10014
NEW YORK
US

Adresa: Address: No. No. Adresa: No. No.

Výrobek: Waren: No. Waren: No.

Prostředí: Větrný: Mass:

621212 815439429433
HOT ROLLED STEEL PLATES

48895k

Vyrobeno v systému jakosti dle ČSN EN ISO 9002.
Made in quality system according to EN ISO 9002.
Hergestellt im Qualitätssicherungssystem laut EN ISO 9002.
Fabriqué en système qualité conformément à la EN ISO 9002.

Druh, rozměr a hmotnost výrobku. Type, Dimension and weight of products.
Art, Abmessungen und Masse der Erzeugnisse. Sorte, dimensions et masse des produits.

19,05-2438-12192 mm
48895 kg
11 Plates
3/4 x 96 x 480"

Jakost: Material quality, Material quality, Qualité

Norma, Standard, Norm, Norme

A516GR70
normalized

GR.70/ASTM A516-90
ASME SA516-90/GR.70
ASTM A-20M 0/0
ASME SA-20M 0/0

A516GR70
normalized

Pole: Part No. of pieces Stück: No. de pièces	Výrobek: Product No. Werkstoff Nr. No. de matière	Tvar: Heat No. Schmelz Nr. No. de la coulée	1	Zkouška: Test No. Probe Nr. No. de l'essai	2	Zkouška: Tension Test, Zugversuch, Essai de traction							Výběr: (1) Impact test (1) Kuchtschlagversuch (1) Essai de Marten			
						3	4	5	6	7	8	9	10	11	12	13

Charpy V-Notch impact test acc. A20M acc. ASTM and acc. SA20M acc. ASME-cl.

1	208391	10311	BO	4599	A q 20	356	544	23.0	1	43	38	48	43	-46
1	208392	23530	BO	4600	A q 20	347	526	24.0	1	45	37	37	40	-46
1	208396	23663	BO	4607	A q 20	373	559	20.5	1	27	52	20	33	-46
1	208397	23663	BO	4608	A q 20	370	559	26.0	1	24	37	43	35	-46
1	208398	23663	BO	4609	A q 20	370	562	23.5	1	43	45	39	42	-46
1	208399	22936	BO	4610	A q 20	367	553	23.5	1	28	23	28	26	-46
1	208400	22936	BO	4611	A q 20	348	536	26.0	1	60	61	46	56	-46
1	208401	23530	BO	4604	A q 20	348	536	23.5	1	38	42	48	43	-46
1	208402	23530	BO	4605	A q 20	351	534	24.0	1	55	48	37	47	-46
1	208403	23530	BO	4606	A q 20	355	536	22.5	1	34	33	25	31	-46
1	208404	22998	BO	4612	A q 20	372	572	20.0	1	25	38	44	36	-46

Heat	C	Mn	Si	P	S	Cu	Ni	Cr	Mo	V	Al	Nb
10311	0.20	1.20	0.30	0.011	0.009	0.03	0.02	0.06	0.01	0.01	0.032	0.01
22936	0.17	1.09	0.24	0.022	0.006	0.06	0.03	0.07	0.01	0.01	0.042	0.01
22998	0.21	1.14	0.29	0.018	0.010	0.07	0.05	0.13	0.01	0.01	0.037	0.01
23530	0.18	1.08	0.23	0.019	0.010	0.08	0.03	0.09	0.01	0.01	0.035	0.01
23663	0.22	1.09	0.27	0.017	0.009	0.10	0.03	0.08	0.01	0.01	0.043	0.01

ALL TEST REPORTS FURN
BY UNI-STEEL, INC.

DATE 3-29-02

CUSTOMER MCLISSI

CUSTOMER P.O. # M-020

CUSTOMER PART #2008

HEAT #23663-208588C

HEAT #

Výrobek: Product: Results of other tests: Ergebnisse anderer Prüfungen: Résultats des autres essais:

NORMALIZED : walking beam furnace - length 70m,
temperature 900-950°C/dwell 16 min.

Tento prohlášení na svou výlučnou odpovědnost, že uvedené výrobky nebyly se vztahují k tomuto prohlášení jsou v souladu s předpisy, které jsou speciálně upraveny kupní smlouvou. Thereby we declare to our exclusive responsibility, that the mentioned products to which this declaration is referred to is in accordance with regulations, which are specified by the contract. Es wird hiermit auf ausschliessliche Verantwortlichkeit erklärt, dass die hier angeführten Erzeugnisse auf die sich diese Erklärung bezieht, entsprechen den im Kaufvertrag spezifizierten Vorschriften. Nous déclarons à notre responsabilité exclusive que les produits mentionnés se réfèrent à cette déclaration sont conformes aux prescriptions spécifiées par le contrat d'achat.



VITKOVICE

VITKOVICE a.s.

706 02 OSTRAVA-VITKOVICE

RUSKÁ 101

1 Zkouška výroby: Steelmaking process, Erzeugung, Mode d'élaboration de l'acier, BO + Y
2 A - Hlava, Tělo, Konec, Hlava, 2 - Kopf, Rumpf, Ende, Hülle, 2 - Head, Body, End, Head
3 - podstředí, longitudo, šířka, g - přírub, transverse, quer, Längserweiter, Längserweiter, Längserweiter, ... - middle, radial, z - vertikální, vertical, senkrecht
4 - Míst, Míst, Yield Stress, Streckgrenze, Limite d'élasticité
5 - test, povrch, Tension strength, Zugfestigkeit, Rm, Résistance Rm
6 - Třída AS, Disposition AS, Denkung AS, Abgemessen AS
7 - Zkouška Z, Reduction of area Z, Bauchversuch Z, Section Z
8 - Průměr, Average, Mittel, Diameter



P.O. BOX 3128 TULSA, OK. 74101

APPLIED HYDRAULIC SYSTEMS, INC
PO BOX 10155, STA 1
HOUMA, LA 70363



TELEPHONE 918/834-4611
TELEX 262569 CRSBY UR
FAX 918/834-9447

CERTIFICATE OF NONDESTRUCTIVE TESTING

INSPECTION PERFORMED ON: 3 PC(S)- M03OD14H 14" 30 TON API 2C CRANE BLOCK
W/.625" WIRE LINE

TESTING SERIAL NO: 02-575-84 Thru 02-575-86

CUSTOMER PURCHASE ORDER NO: 64075

CROSBY W/O ORDER NO: 545681

TEST PERFORMED:

_____ ULTRASONIC INSPECTION PER ASTM A-388.
ACCEPTANCE CRITERIA:

_____/✓✓✓/ MAGNETIC PARTICLE INSPECTION OF SHEAVE PER ASTM E-709.
_____/✓✓✓/ WET METHOD _____ DRY METHOD.

_____ DYE PENETRANT INSPECTION PER ASTM E-165.
ALTERNATE SPECIFICATION:

DEFECTS AND DISPOSITION: NO REJECTABLE INDICATIONS
PART NO: 8011196

PICS:	TRUNNION - BHBC	PIN - BBCK
	PLATE DE-ADAPTER - ZHBD	
SERIAL NO:	HOOK:	SIDE PLATES:
02-575-84	5BK	BHBH
02-575-85	5BK	CHBF
02-575-86	5BB	CHBF

WE CERTIFY THAT THE INDICATED INSPECTIONS WERE PERFORMED ON THE
DESCRIBED MATERIAL.

DATE: 04/18/02

BY:


DION DOUT, INSPECTOR LEVEL II

Products of uncompromising quality . . .

CROSBY Clips & Fittings, LEBUS Load Binders, McKISSICK Blocks & Sheaves, CROSBY- WESTERN Blocks, NATIONAL Swaging Systems

Plants and facilities in: Jacksonville, Arkansas - Los Angeles, California - Atlanta, Georgia - Chicago, Illinois - Tulsa, Oklahoma - Harrisburg, Pennsylvania
Dallas, Texas - Longview, Texas - Seattle, Washington - Toronto (Brampton), Ontario - Barnsley, England - Mechelen (Putte), Belgium - Cergy St. Christophe, France

The Crosby Group

Procedure for Certifying Nondestructive Test Personnel

Personnel Certification Summary

Employee Dion Dout Certification Card No. N/A

Test Method Magnetic Particle Certification Level II

Division McKissick Certification Date 7/27/98

Restriction to Certification (if any): None

1. Background and Experience Record:

3-95 to 7-98 Level I, in training

7-98 Level I

7-98 to present Level II

2. Training Course Record:

12 Hrs. Level I - John Edwards - 7/21/98

8 Hrs. Level II - John Edwards - 7/27/98

3. Physical Examination Record: Ishihara 14/14

Color Contrast: Capable of distinguishing and differentiating contrast between colors
Used in all NDE.

Near Vision: 20/20 both eyes, with uncorrected vision.

Able to read min. Jaeger #1 at 12 in.

Date: 04/18/02

4. Technical Examination Record:

<u>Examination</u>	<u>Date</u>	<u>% Score</u>	<u>Weight</u>	<u>Score</u>	<u>Grade</u>	<u>Examiner</u>
<u>General</u>	<u>7/27/98</u>	<u>92</u>	<u>.4</u>	<u>36.8</u>		<u>J. Edwards</u>
<u>Specific</u>	<u>1/25/01</u>	<u>91</u>	<u>.3</u>	<u>27.3</u>		<u>D. Conner</u>
<u>Practical</u>	<u>7/27/98</u>	<u>100</u>	<u>.3</u>	<u>30</u>	<u>94.1</u>	<u>J. Edwards</u>
<u>General</u>	<u>7/24/01</u>	<u>93</u>		<u>Re-Certified</u>		<u>D. Conner</u>

5. Examiners Comments: Based on education, examinations, experience, and satisfactory job performance, Dion Dout is certified to Level II in accordance with the requirements of ASNT-TC-1A.

The Crosby Group, Inc.
Certifying Agency


Examiner's Signature

Calibration Report

Machine: Magnaflux

S/N 54333R273B

Location: Crosby McKissick

RESULTS

HEAD				COIL			
Duration	AMPS	Results	%	Duration	AMPS	Results	%
1.75	500	483	.03	1.73	300	323	.07
1.87	2200	2250	.02	1.58	1000	966	.03
2.54	2600	2570	.01	1.33	1300	1289	.01
2.40	3000	3140	.04	2.89	1600	1600	0
2.40	3200	3140	.02	1.71	1800	1740	.03
2.40	3800	3720	.02	1.93	2000	2040	.02
2.50	4250	4340	.02	1.86	2400	2350	.02
2.30	5000	4990	0	2.17	2750	2690	.02
2.0	6200	6230	0	2.15	3250	3260	0

Calibration Date: 12/18/01

Due Date: 6/15/02

Calibrated in accordance with ASTM-E709 Requirements.

CALIBRATION EQUIPMENT

Machine: ATS-20B

S/N: 2901131

Calibration Date: 10-22-01

Due Date: 4-21-02

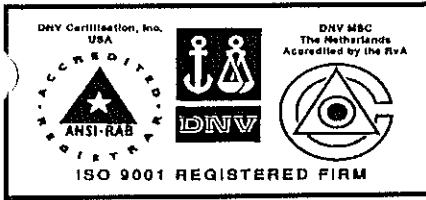
Calibrated By:

Don Connor

OVERHAUL BALL CERTIFICATES

McKISSICK[®]

P.O. BOX 3128 TULSA, OK. 74101



the Crosby group,
inc.[®]

TELEPHONE 918/834-4611
TELEX 262569 CRSBY UR
FAX 918/834-9447

**APPLIED HYDRAULIC
SYSTEMS, INC.**

SERIAL NO:

00-251-39

CROSBY PART NO: 8009632

CROSBY CG NO: 167362

CUSTOMER PO#: 50539

DESCRIPTION:

**200 TS 7 TON API 2C
OVERHAUL BALL (210#)**

products of uncompromising quality . . .

CROSBY Clips & Fittings, LEBUS Load Binders, McKISSICK Blocks & Sheaves, CROSBY- WESTERN Blocks, NATIONAL Swaging Systems

*Plants and facilities in: Jacksonville, Arkansas - Los Angeles, California - Atlanta, Georgia - Chicago, Illinois - Tulsa, Oklahoma - Harrisburg, Pennsylvania
Dallas, Texas - Longview, Texas - Seattle, Washington - Toronto (Brampton), Ontario - Barnsley, England - Mechelen (Putte), Belgium - Cergy St. Christophe, France*

PART OF THE  FKI GROUP OF COMPANIES

McKISSICK®

P.O. BOX 3128 TULSA, OK. 74101

**the Crosby® group,
inc.**

TELEPHONE 918/834-4611
TELEX 262569 CRSBY UR
FAX 918/834-9447

INDEX

- ORDER
- CERTIFICATE OF CONFORMANCE
- MATERIAL CERTIFICATION

Products of uncompromising quality . . .

CROSBY Clips & Fittings, LEBUS Load Binders, McKISSICK Blocks & Sheaves, CROSBY- WESTERN Blocks, NATIONAL Swaging Systems

*Plants and facilities in: Jacksonville, Arkansas - Los Angeles, California - Atlanta, Georgia - Chicago, Illinois - Tulsa, Oklahoma - Harrisburg, Pennsylvania
Dallas, Texas - Longview, Texas - Seattle, Washington - Toronto (Brampton), Ontario - Barnsley, England - Mechelen (Putte), Belgium - Cergy St. Christophe, France*

PART OF THE  FKI GROUP OF COMPANIES

Regular Order

Entered By DOUG 4/20/00

Customer No. 2980 Order Number 167362 Last maintained by 0/00/00

APPLIED HYDRAULIC SYSTEMS, INC APPLIED HYDRAULIC SYSTEMS, INC

BOX 10155, STA 1

204 INDUSTRIAL AVE C

HOUMA

LA

HOUMA

LA

70363

70363

Customer PO # Ship Via PO Date Order Date Ship-to PO # Whse SR DR

50539 4/19/00 4/19/00 MK 52 - 12

Inv#: Ship: Frt Amt: Pick: Shipv:

Inv Date: 0/00/00 Frt Code: 1 Ship Info.: 0000000 00

Line Qty Qty Invoice Priority: 1

Ordered Allocat. Prod. # WH U Sts Ctlg and Description Sell Price

SH- JOB 040004

1	1	0 8012399	MK	ENT 382	CRANE BLK	3/4WL
1	1	1 8009632	MK	INV UB500	UTILITY OHB	7T 200#
				SE	YELLOW	
				HB	YELLOW	
				LA	YELLOW	
				CH	AM FRT	
				LV	SAIA	

Records to Roll (1-24): 8 Total Weight 1090.00 Order Total:

F1=End F3=Fold F6=New Inquiry F24=More keys

the Grosby[®] group, inc.

**CERTIFICATE OF CONFORMANCE OF CHAINS, RINGS, HOOKS, SHACKLES,
SWIVELS AND PULLEY BLOCKS**

(7) Name and address of makers or suppliers **The Crosby Group / McKissick Products**
2801 Dawson Road Tulsa OK 74110-5040 U.S.A.

(8) Name and address of public service, association, company or firm making the test and examination _____
Same

(9) Position of signatory in public service, association, company or firm _____
QUALITY ASSURANCE SUPERVISOR

(Date) April 20, 2000 (Signature) Buck Weaver
Buck Weaver

CERTIFICATE OF MATERIAL TEST REPORTS



CUSTOMER

MC KISSICK PRODUCTS CO
2857 DAWSON ROAD
PO BOX 3128
TULSA OK 74101-3128 USA

CASTLE METALS CERTIFIES THAT THE FOLLOWING INFORMATION IS TAKEN FROM CHEMICAL AND METALLURGICAL TEST REPORTS FURNISHED TO US BY OUR SUPPLIER AND WHICH ARE ON FILE IN OUR OFFICE.

WE CERTIFY THAT WE HAVE NO KNOWLEDGE OF MERCURY OR RADIOACTIVE MATERIAL USED IN THE MELTING OR PROCESSING OF STEEL SOLD BY OUR COMPANY.

MANUFACTURER (MILL) NORTH STAR STEEL COMPANY			CUST. ORDER NO. M-9906788		CUST. REQUISITION NO.	
IAC 2097	HEAT NO. M74134 H1093	ORDER NO. 334347	LINE NO. 1	SHIP QTY. 45.0	SHIP DATE 11/09/99	

DESCRIPTION

1-1/4" RD A4140 CF HT A193-B7 10/13 PART NO. 94524

* * * CHEMICAL ELEMENTS * * *									
C	MN	P	S	SI	NI	CR	MO	AL	
.42	.88	.015	.033	.27	.05	.97	.18	.029	
CU	V	PB	TI	CO	CB				
.12	.006	.00/.00	.002	.007	.002				

* * * MECHANICAL PROPERTIES * * *

TENSILE 145000 PSI, YIELD 130000 PSI, ELONG 18.8, R.A. 58.1
HARDNS BHN 297/ 297, GRAIN = FINE, GRAIN 5/ 8, MACRO - S1 R1 C1, R.R. 26.6
CAST = STRAND, MERCURY FREE, WELD FREE, MEETS NAFTA = Y

* J O M I N Y *

1	2	3	4	5	6	7	8	12	16	20	24	28	32
57	57	57	57	57	57	57	55	49	45	44	42	40	37

* * * INDUSTRY SPECIFICATIONS * * *

A.I.S.I.-4140, ASME SA 193 B7 95ED 96AD, ASTM-A193-97A-GR-B7, ASTM-A29-93A :
ASTM-A331-95-FASTENER QUALITY ACT, ASTM-A434-90A-CLS-BC
(1/4" THROUGH 4" ONLY), UNS#-G41400
VD Q&T SF **T&P @ HA INDUSTRIES FROM IAC 16578** RD-46840 4-1999 NORTH STAR T
ENSILE #2 147,000 PSI, YIELD 133,000 PSI, ELONG. 18.6, R.A. 58.2 AUST: 1500 F
26 MIN / QUENCH: WATER / TEMPER: 1180 F 36 MIN RD-48191 11-1999

BOLT ASSY: PIC-YBCL
HEAT CODE—M74134 H1093

11/18/99
A.M. CASTLE & CO.
Armonia Go...



P.O. BOX 3128 TULSA, OK. 74101



MATERIAL DATA

CROSBY/McKISSICK PRODUCT
NUMBER: 2008346

TELEPHONE 918/834-4611
TELEX 262569 CRSBY UR
FAX 918/834-9447

DATE: 01/04/99

DESCRIPTION/SPECIFICATIONS:

SWIVEL LOWER EYE

PIC: H60

CHEMICAL ANALYSIS

HEAT NO: H60	C. .1555	Mn. .7877	P .0176	S .0170	Si .5213
	Cr .6931	Mo .2202	Ni .4867	Cu .0988	Al .0031
	V .0013				

PHYSICAL PROPERTIES

(P S I)

YIELD STRENGTH

96,300

TENSILE STRENGTH

112,600

ELON %

21

RED OF AREA %

56

BHN

241

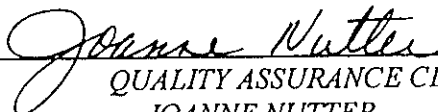
CHARPY "V" NOTCH

-25° F (FT-LBS)

31-51-23

THE ABOVE DATA WERE TRANSCRIBED FROM THE MANUFACTURER'S CERTIFICATE OF TEST AFTER A VERIFICATION FOR COMPLETENESS AND SPECIFICATION REQUIREMENTS OF THE INFORMATION ON THE CERTIFICATE. ALL TEST RESULTS REMAIN ON FILE SUBJECT TO EXAMINATION.

THE WILLFUL RECORDING OF FALSE, FICTITIOUS, OR FRAUDULENT STATEMENTS IN CONNECTION WITH TEST RESULTS MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTES.


QUALITY ASSURANCE CLERK
JOANNE NUTTER

products of uncompromising quality . . .

CROSBY Clips & Fittings, LEBUS Load Binders, McKISSICK Blocks & Sheaves, CROSBY- WESTERN Blocks, NATIONAL Swaging Systems

Plants and facilities in: Jacksonville, Arkansas - Los Angeles, California - Atlanta, Georgia - Chicago, Illinois - Tulsa, Oklahoma - Harrisburg, Pennsylvania
Dallas, Texas - Longview, Texas - Seattle, Washington - Toronto (Brampton), Ontario - Barnsley, England - Mechelen (Putte), Belgium - Cergy St. Christophe, France

PART OF THE  FKI GROUP OF COMPANIES

GOLTRA CASTINGS COMPANY, INC.

501 McIntyre STREET
Golden, Colorado 80401
PHONE 303-279-7818

DATE: 8/16/98

ASTM SPECIFICATION

CUSTOMER DESCRIPTION

ASTM-A-487 Grade 4B

McKissick
P/N 7-S-4

TENSILE TEST PER ASTM E 8

HEAT CODE	YIELD PSI	TENSILE PSI	ELONGATION %	REDUCTION IN AREA %
H60	96,300	112,600	21.0	56.2

Brinell 241

Quench and Temper

CHEMICAL COMPOSITION

Carbon	Silicon	Molybdenum
.1555	.5213	.2202
Aluminum	Manganese	Copper
.0031	.7877	.0988
Phosphorous	Nickel	Vanadium
.0176	.4867	.0013
Sulfur	Chromium	
.0170	.6931	

CHARPY IMPACT TEST PER ASTM A370 FIG. 1

TYPE OF SPECIMEN: CHARPY V NOTCH

SPECIMEN	#1	#2	#3
IMPACT VALUE	31.0	51.0	23.0

METHOD OF TEST ASTM E 23

TEST TEMPERATURE -25 degree F

I HEREBY CERTIFY THAT THE ABOVE INFORMATION IS CORRECT:


GOLTRA CASTING COMPANY, INC.
Larry Draper, General Manager

Pr
10-2-98

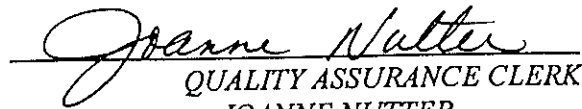
TELEPHONE 918/834-4611
TELEX 262569 CRSBY UR
FAX 918/834-9447**CROSBY/McKISSICK PRODUCT**
NUMBER: 8009913**DATE: 01/04/99****DESCRIPTION/SPECIFICATIONS:****SWIVEL EYE BARREL****PIC: 016****CHEMICAL ANALYSIS**

HEAT NO: VK	C. .19	Mn. .71	P .02	S .03	Si .59
	Cr .52	Mo .19	Ni .53	Cu .14	

PHYSICAL PROPERTIES**(P S I)****YIELD STRENGTH****76,500****TENSILE STRENGTH****95,000****ELON %****11****RED OF AREA %****18****CHARPY "V" NOTCH****-25° F (FT-LBS)****21-18-17**

THE ABOVE DATA WERE TRANSCRIBED FROM THE MANUFACTURER'S CERTIFICATE OF TEST AFTER A VERIFICATION FOR COMPLETENESS AND SPECIFICATION REQUIREMENTS OF THE INFORMATION ON THE CERTIFICATE. ALL TEST RESULTS REMAIN ON FILE SUBJECT TO EXAMINATION.

THE WILLFUL RECORDING OF FALSE, FICTITIOUS, OR FRAUDULENT STATEMENTS IN CONNECTION WITH TEST RESULTS MAY BE PUNISHABLE AS A FELONY UNDER FEDERAL STATUTES.


QUALITY ASSURANCE CLERK
JOANNE NUTTER

products of uncompromising quality . . .

CROSBY Clips & Fittings, LEBUS Load Binders, McKISSICK Blocks & Sheaves, CROSBY- WESTERN Blocks, NATIONAL Swaging Systems

Plants and facilities in: Jacksonville, Arkansas - Los Angeles, California - Atlanta, Georgia - Chicago, Illinois - Tulsa, Oklahoma - Harrisburg, Pennsylvania
Dallas, Texas - Longview, Texas - Seattle, Washington - Toronto (Brampton), Ontario - Barnsley, England - Mechelen (Putte), Belgium - Cergy St. Christophe, France



N.A.P.C.

NORTH AMERICAN PRECISION CASTING

CERTIFICATE OF CONFORMANCE

DATE: June 3, 1998

THIS IS TO CERTIFY THAT THE PARTS LISTED BELOW WERE MANUFACTURED TO THE SPECIFICATIONS AS INDICATED BELOW.

COMPANY:	McKissick
P.O. NUMBER:	M-9800699
PART NUMBER:	230379 - 5 Ton Eye Barrel
N.A.P.C. NUMBER:	142-006
ALLOY:	ASTM A487 Grade 4 Class B
HEAT NUMBER(S):	4-6-1998 #5 through 19
PIC CODE:	016

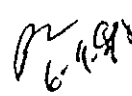
NUMBER OF PARTS ON THIS ORDER: 335

CHEMICAL ANALYSIS

ELEMENT TESTED	RESULTS (%)
C	0.19
Mn	0.71
P	0.02
S	0.03
Si	0.59
Cu	0.14
Ni	0.53
Cr	0.52
Mo	0.19
Fe	BASE

QUALITY ASSURANCE:


STUART K. BENSCH



708 N. 29th Street * P.O. Box 580 * Blackwell, OK 74631 * (580) 363-1412 * (580) 363-5712 FAX
356 Langston Circle*Golden Triangle Industrial Park*P.O. Box 1407*Columbus, MS 39703 * (601) 245-1155 * (601) 245-4697 FAX

FORM NAME (CERT) STUART

TEST REPORT



MIDSTATES ANALYTICAL LABORATORIES, INC.

3100 N. Hemlock Circle
Muskogee, OK 74402

P.O. Box 800328
Tulsa, OK 74108

(918) 258-8066
Fax (918) 258-1164

TO Gary Hamilton
Thermal Specialties
P.O. Box 9426
Tulsa, OK 74157-0426

Page 1 of 1
98-16096

NO. May 27, 1998
DATE P.O. 34943

Sample Number

805MS363

Customer's Material Description

Test Bar And Charpy Block Identified
Code "VK", ASTM A487 GR4 CLB; NACP
P.O. 26262

Tensile Test: Per ASTM A370-96 - Specimen Type: 0.500 Inch Round

Yield Strength at 0.2% Offset - psi	Ultimate Tensile Strength - psi	Elongation in 2 in. Percent	Reduction of Area Percent
76,500	95,000	11	18

Impact Test:

Method of Test: ASTM A370-96/ASTM E23-96
Specimen Type: Type A (Charpy V)
Notch Orientation: Perpendicular to Surface
Specimen Size: 10 x 10 mm
Test Temperature: -25°F
Impact Values (Ft-Lbs) 2, 3, 2
Lateral Expansion (Mils) 2, 3, 2
Percent Shear: <10, <10, <10

Before me, the undersigned, a Notary Public in and for said County and State, on this _____ day of _____, 19____, personally appeared _____, to me known to be the identical person who executed the within and foregoing instrument and acknowledged to me that he executed the same as his free and voluntary act and deed for the uses and purposes therein set forth.
Given under my hand and seal the day and year first above written.
My commission expires: _____

Notary Public

SOPP43REV0

This is to certify that the above is a true report of the results obtained by Midstates Analytical Laboratories. Test results relate only to the items tested. Report shall not be reproduced except in full, without the written approval of Midstates Analytical Laboratories.

By Larry J. Pate
Larry J. Pate, Operations Mgr

CENTRAL MACHINE & TOOL
HEAT TREAT DIVISION
CERTIFICATION

To: N.A.P.C.-Blackwell
P.O. Box 580
Blackwell, OK 74631

Date: June 1, 1998

Ref: P.O.: 26262

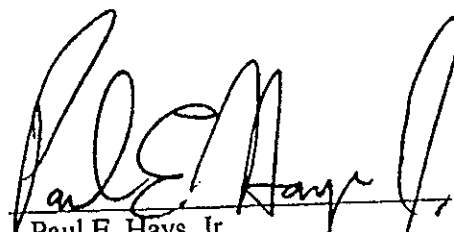
P.N.: McKissick P/N 5 T Eye Barrel

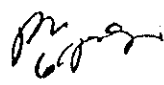
Qty.: 336 pcs.

Material: ASTM A467 Gr. 4 Class B
Carbon Restore, Harden & Temper to 105 TS/ 85 YS (BHN 217-248)

We certify that the above listed part numbers of the specified material were processed in accordance with appropriate industry standards to the condition requested on referenced purchase order.

Brinell Hardness Tested To: BHN 229


Paul E. Hays, Jr.
Manager-Heat Treat Division
Central Machine & Tool Co.





6825 East 38th Street
Tulsa, OK 74143-3241
Telephone 918-664-7767

SHERRY LABORATORIES
INDIANA LOUISIANA OKLAHOMA
Metals Testing Services, Inc.

Fax 918-627-3062
800-324-8378

LABORATORY REPORT

Attn: Paul Hays
Central Machine & Tool
P.O. Box 3908
Enid OK, 73702

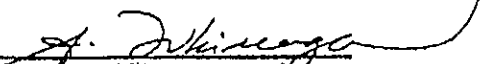
Report No: 1998080225-1
Date Received: 06/12/98
Date Reported: 06/16/98
P.O. No: 6288

Sample Description: McKissick 5 ton Eye Barrel.
HT: CR-A-Q-T
TB - "VK"
Material: ASTM A487 Gr. 4 Cl. 8

Impact Test Report

Style and Model of Machine: Tinius Olsen, 74
Available Impact Energy: 264 Ft-Lbs.
Impact Velocity: 17 Ft/Sec.
Method of Test: SA-370/ASTM-E23
Specimen Type: Charpy "V" Notch
Specimen Location: ASTM-A370-Longitudinal
Notch Orientation: ASTM-A370
Specimen Size: 10mm X 10mm
Test Temperature: -25 °F

Notch Location: Base
Surface Impact Values (Ft-Lbs.): 21, 18.0, 17.0

Approved By: 
Aurelio Zubillaga, Supervisor
Metallurgical/Mechanical Testing



N.A.P.C.

NORTH AMERICAN PRECISION CASTING

CERTIFICATE OF CONFORMANCE

DATE: August 25, 1998

THIS IS TO CERTIFY THAT THE PARTS LISTED BELOW WERE MANUFACTURED TO THE SPECIFICATIONS AS INDICATED BELOW.

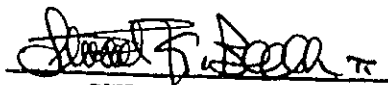
COMPANY:	McKissick
P.O. NUMBER:	M-9802530
PART NUMBER:	230690 - 5T Base Plug
N.A.P.C. NUMBER:	142-009
ALLOY:	ASTM A487 Grade 4 Class B
HEAT NUMBER(S):	7/27/1998 #4 through 9
PIC CODE:	021

NUMBER OF PARTS ON THIS ORDER: 550

CHEMICAL ANALYSIS

ELEMENT TESTED	RESULTS (%)
C	0.15
Mn	0.78
P	0.02
S	0.02
Si	0.57
Cu	0.13
Ni	0.49
Cr	0.46
Mo	0.17
Fe	BASE

QUALITY ASSURANCE:


STUART K. BENSCH

708 N. 29th Street * P.O. Box 580 * Blackwell, OK 74631 * (580) 363-1412 * (580) 363-5712 FAX
356 Langston Circle*Golden Triangle Industrial Park*P.O. Box 1407*Columbus, MS 39703 * (601) 245-1155 * (601) 245-4697 FAX

DRM (CERT) STUART

**CENTRAL MACHINE & TOOL
HEAT TREAT DIVISION
CERTIFICATION**

To: N.A.P.C.-Blackwell
P.O. Box 580
Blackwell, OK 74631

Date: August 14, 1998

M-9802530

Ref: P.O.: 26473

P.N.: McKissick P/N 230690 5T Base Plug

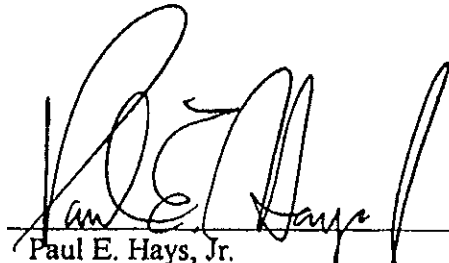
Qty.: 550 pcs.

Material: ASTM A487 Gr. 4 Cl. B
Carbon Restore, Anneal, Quench, Temper to 105TS / 85YS
(BHN 217-248)

PIC 021

We certify that the above listed part numbers of the specified material were processed in accordance with appropriate industry standards to the condition requested on referenced purchase order.

Brinell Hardness Tested To: BHN 229


Paul E. Hays, Jr.
Manager-Heat Treat Division
Central Machine & Tool Co.

10/14/96
EP

TEST REPORT



MIDSTATES ANALYTICAL LABORATORIES, INC.

3100 N. Hamlock Circle
Broken Arrow, OK 74012P.O. Box 880328
Tulsa, OK 74188(918) 258-8086
Fax: (918) 258-1184TO: Paul Hays
Central Machine & Tool Company
P.O. Box 3909
Enid OK 73702Page 1 of 1
NO. 98-18127
DATE October 12, 1998
P.O. 6865Sample Number

810MS124

Customer's Material DescriptionTest Block Identified ASTM A487
Gr 4 CL B McKissick 230690 5T
Base Plug, TB=XL

M-9802530

Impact Test:

Method of Test:	ASTM A370-96/ASTM E23-96
Specimen Type:	Type A (Charpy V)
Notch Orientation:	Perpendicular to Surface
Specimen Size:	10 x 10 mm
Test Temperature:	-25° F
Impact Values (Ft-Lbs)	12, 16, 18
Lateral Expansion (Mils)	10, 13, 18
Percent Shear:	10, 10, 10

Before me, the undersigned, a Notary Public in and for said County and State, on this _____ day of _____, 19____, personally appeared _____, to me known to be the identical person who executed the within and foregoing instrument and acknowledged to me that he executed the same as his free and voluntary act and deed for the uses and purposes therein set forth.
Given under my hand and seal the day and year last above written.
My commission expires: _____

SOPD8REVO

Notary Public

This is to certify that the above is a true report of the results obtained by Midstates Analytical Laboratories. Test results relate only to the items tested. Report shall not be reproduced except in full, without the written approval of Midstates Analytical Laboratories.

By _____

Larry J. Pale, Operations Mgr.



6825 East 34th Street
Tulsa, OK 74145-3241
Telephone 918-644-7767

SHERRY LABORATORIES
INDIANA LOUISIANA OKLAHOMA
Service Training Services, Inc.

Fax 918-627-3082
800-321-6378

LABORATORY REPORT

Attn: Paul Hays
Central Machine & Tool
P.O. Box 3809
Enid, OK, 73702

Report No: 1988090308-1
Date Received: 09/21/98
Date Reported: 09/24/98
Project No: 4950
P.O. No: 8735

Sample Description: McKlesick 230680, 5 Ton Base Plug (142-009). PIC 021
Reference P.O. No: 26473
Material: ASTM A487 Gr. 4 Class B, Carbon restore, Anneal, Quench & Temper.
TB = "XL"

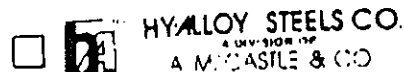
M-9802530

Room Temperature Tensile Test (ASTM E 8-98), Transverse

Parameter	Result
Diameter, in.	.368
Tensile Strength, psi	105,900
Yield Strength, psi by 0.2% offset	90,700
Elongation in 4D, %	20
Reduction of Area, %	87

Approved By: Aurelio Zubillaga
Aurelio Zubillaga, Supervisor
Metallurgical/Mechanical Testing

CERTIFICATE OF MATERIAL TEST REPORTS


CUSTOMER

MC KISSICK PRODUCTS CO
2857 DAWSON ROAD
PO BOX 3128
TULSA OK 74101-3128 USA

CAST E METALS CERTIFIES THAT THE
FOLLOWING INFORMATION IS TAKEN
FROM CHEMICAL AND METALLURGICAL
TEST REPORTS FURNISHED TO US BY
OUR SUPPLIER AND WHICH ARE ON FILE
IN OUR OFFICE

WE CERTIFY THAT WE HAVE NO KNOWLEDGE
OF MERCURY OR RADIOACTIVE MATERIAL USED
IN THE MELTING OR PROCESSING OF STEEL
SOLD BY OUR COMPANY

MANUFACTURER (MILL)		CUST. ORDER NO.		CUST. REQUEST ON NO.	
CSC		M-9802959			
AC	HEAT NO.	ORDER NO.	LINE NO.	SHIP QTY	SHIP DATE
2097	M68396	188791	1	627.0	

DESCRIPTION

1-1/4 RD A4140 CF HT A193-B7 10/13 PART NO. 94524

* * * CHEMICAL ELEMENTS										* * *
C	MN	P	S	SI	NI	CR	MO	AL		
.407	.90	.011	.027	.26	.06	.96	.18	.023		
CU	V	TI	CO	SN						
.15	.005	.003	.0073	.009						

* * * MECHANICAL PROPERTIES

TENSILE 143480 PSI, YIELD 125760 PSI, ELONG 19.0, R.A. 58.6
HARDNS BHN 311/ 311, GRAIN = FINE, GRAIN 5/ 8, MACRO - S1 R1 C1 ASTM E381
R.R. 24.2
H BAND = Y, MERCURY FREE, MEETS NAFTA = Y

J O M I N Y														* * *
1	2	3	4	5	6	7	8	12	16	20	24	28	32	
57	56	56	55	54	54	54	53	48	44	43	39	39	41	

* * * INDUSTRY SPECIFICATIONS

A.I.S.I.-4140, ASME SA193 95 GR B7, ASTM-A29-93A, ASTM-A434-90A-CLS-BC
(1/4" THROUGH 4" ONLY), ASTMA 193 96A GR B7, ASTMA 304 95, ASTMA 322 91
ASTMA 331 90(95), UNS#-G41400
NORTH STAR HR AR VD **CONV Q&T T&P OIL @ CSC FROM 1-38" ** RD-42900 2-1998

BOLT ASSY
1.250 X 10.625 PIC-XBCR

BOLT ASSY
1.250 X 5.150 PIC-XBCR

A M CASTLE & CO
Amenia Watson

5/14/98
EP

END



SHERRY LABORATORIES
INDIANA LOUISIANA OKLAHOMA
Metals Training Services, Inc.

Fax 918-627-3062
800-324-8378

1818 East 18th Street
Tulsa, OK 74145-3241
Telephone 918-664-7767

LABORATORY REPORT

Attn: Steve Kendrick
The Crosby Group, Inc.
P.O. Box 3128
Tulsa OK, 74101

Report No: 1998050222- 1
Date Received: 05/14/98
Date Reported: 05/18/98
P.O. No: M9803242

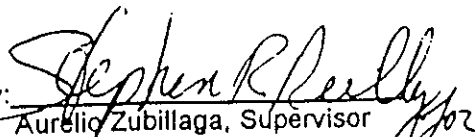
Sample Description: 1.25" bar, API 2C
Heat No: M68396
PIC Code: XBCR
WO#: 196902 - P/N: 2015011.
Specimen removed from 4/5 radius.

Test Report (ASTM E 8-96) RT, Longitudinal Tensile

<u>Parameter</u>	<u>Result</u>
Diameter, in.	.503
Tensile Strength, psi	144,500
Yield Strength, psi by 0.2% offset	128,600
Elongation in 4D, %	20
Reduction of Area, %	63

Hardness Test

Testing Specification: ASTM E18-94
Hardness Scale: ROCKWELL "C"
Acceptance Criteria: N.A.
Actual Coupon Hardness: 29.0, 28.0, 29.0

Approved By: 
Aurelio Zubillaga, Supervisor
Metallurgical/Mechanical Testing



SHERRY LABORATORIES
INDIANA LOUISIANA MISSISSIPPI
Welding Testing Services, Inc.

Fax 918-627-3062
800-324-8378

LABORATORY REPORT

Attn: Steve Kendrick
The Crosby Group, Inc.
P.O. Box 3128
Tulsa OK, 74101

Report No: 1998050222- 1
Date Received: 05/14/98
Date Reported: 05/18/98
P.O. No: M9803242

Sample Description: 1.25" bar, API 2C
Heat No: M68396
PIC Code: XBCR
WO#: 196902 - P/N: 2015011.
Specimen removed from 4/5 radius.

Impact Test Report

Style and Model of Machine: Tinius Olsen, 74
Available Impact Energy: 264 Ft-Lbs.
Impact Velocity: 17 Ft/Sec.
Method of Test: SA-370/ASTM-E23
Specimen Type: Charpy "V" Notch
Specimen Location: ASTM-A370 Longitudinal
Notch Orientation: ASTM-A370
Specimen Size: 10mm X 10mm
Test Temperature: -25 °F

Notch Location: Base
Impact Values (Ft-Lbs.): 66, 61, 67
Lateral Expansion(Mils): 24, 23, 20
Shear(%): 60, 60, 65

Approved By:

Stephen R. Kelly Jr.
Aurelio Zubillaga, Supervisor
Metallurgical/Mechanical Testing

M9804738 HT 388457
(1R) 3144964 240 A514 Plate

2/4 X 70 X 240 11.5-11

OREGON STEEL MILLS

P.O. BOX 2760, Portland, Oregon 97208 • (503) 286-9651 Fax (503) 240-5268

REPORT OF CHEMICAL/PHYSICAL TESTS

THE FIRST ISO 9002 REGISTERED U.S. PAT. PEND.		STEEL SERVICE CO 6725 AMAH PARKWAY CLAREMORE, OK 74017		STEEL SERVICE CO 6725 AMAH PARKWAY CLAREMORE, OK 74017	
S O L D T O		CERTIFICATE NO. 478058P MILL ORDER NO. 77988 CUSTOMER ORDER NO. 23333 JOB/REQ. NO.		DATE APR 21, 1998 DATE 04/21/1998	
THIS MATERIAL HAS BEEN MANUFACTURED, TESTED AND FOUND TO MEET THE SPECIFICATIONS AND PURCHASE ORDER REQUIREMENTS OSM ALLOY STRUCTURAL QUALITY PLATE ASTM A514-94A GR B.		SHIPPING NO. 478058 CARRIER BURLINGTON NORTHERN CAR/TRUCK NO. BN621087		PAGE 5	

PHYSICAL PROPERTIES

CSM ITEM NO.	DESCRIPTION	HEAT NO.	SLAB	YIELD PSI X 100	TENSILE PSI X 100	% ELONG 8" 2"	% RA	HARDNESS BHN	BEND TEST	IMPACTS
3	0.7500 X 96.000 X 240.000 1 PC 4901 LBS 98A3832 + THE FOLLOWING PLATES WERE AUSTENITIZED AT 1680 DEGS F FOR 32 MINUTES AND WATER THEN TEMPERED AT 1250 DEGS F FOR 38 MINUTES AND AIR COOLED	388375	E1	1120	1200	32	48			QUENCHED
	1 PC 4901 LBS 98A3834 +	388657	A2	1050	1140	32	49			QUENCHED
	THE FOLLOWING PLATES WERE AUSTENITIZED AT 1680 DEGS F FOR 31 MINUTES AND WATER THEN TEMPERED AT 1250 DEGS F FOR 39 MINUTES AND AIR COOLED									QUENCHED
	1 PC 4901 LBS 98A3835 +	388657	A2	1070	1160	34	52			QUENCHED
	THE FOLLOWING PLATES WERE AUSTENITIZED AT 1680 DEGS F FOR 30 MINUTES AND WATER THEN TEMPERED AT 1250 DEGS F FOR 38 MINUTES AND AIR COOLED									QUENCHED
	1 PC 4901 LBS 98A3833 +	388659	A1	1060	1160	33	49			QUENCHED
	1 PC 4901 LBS 98A3833 +	388659	A1	1060	1160	33	49			QUENCHED

PIC: XHBS

SIDE PLATE

CHEMICAL ANALYSIS

HEAT NO.	C	Mn	P	S	Si	Cu	Ni	V	Cr	Mo	Ti	B	Nb	Ca	CE
388375	.19	.95	.007	.003	.31	.22	.08	.031	.032	.56	.22	.032	.0025	.0093	
388657	.19	.92	.007	.005	.29	.30	.14	.037	.027	.54	.22	.029	.0031	.0098	
388659	.19	.93	.007	.002	.33	.32	.11	.034	.030	.55	.20	.033	.0032	.0098	
ALL HEATS INDICATED WITH (+) WERE MELTED AND MANUFACTURED IN THE USA.															



1/2 3/16
1/2 3/16

I certify the above to be correct as contained in the records of OREGON STEEL MILLS By Colleen Shamel J.C. SHAMER

CERTIFIED MATERIAL TEST REPORT

Order Date: 05/21/1999
PO No: 51074
Mill Order No: 1908191
Load No: 538453
Manifest No: 1298758

Ship To: 2
LEBUS MANUFACTURING
900 FISHER ROAD
LONGVIEW
75604

Bill To:
LEBUS MANUFACTURING
SUB CROSHY GROUP
P.O. BOX 271
LONGVIEW
75606

TX
US

TX
US

PRODUCT
ROUNDS

LENGTH
18 FT 3 IN

GRADE
4130R 1

SIZE
1 7/8 ROUNDS

SPECIFICATIONS

ASTM A29-93a, A322-91

HEAT NO: 11429610

C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn	V	Al	Nb	Ti	CE
.31	.59	.011	.010	.24	.30	.12	.92	.170	.011	.004	.027	.002	.003	.7

Grain Size Practice: FINE GRAIN

Normalizing temp: 1650 °F 899 °C

Quench temp: 1600 °F 871 °C

COMING RESULTS:

J2 J6
50 38

SOUNDNESS E381 CLEANLINESS TURNDOWN

OXIDE SILICATE FREQUENCY SEVERITY SPECIMEN TYPE

S R C 0 0 0 072

1 1 1 0 0 072

CHEMICAL ANALYSIS

PHYSICAL PROPERTIES

All manufacturing processes of this product, including melting and casting, occurred in the U.S.A.

"I hereby certify that the contents of this report are correct and accurate. All tests and operations performed by this material manufacturer or its sub-contractors, when applicable, are in compliance with the requirements of the material spe

Signed: Tom L. Harrington Date: Aug. 18, 1999 Signed: Notary Public (if applicable) Date: _____
Tom L. Harrington: Quality Assurance Manager Page: 1 of 1



SHERRY LABORATORIES MIDSTATES

INDIANA OKLAHOMA LOUISIANA
800-874-3563 800-324-8378 800-737-2378



Non-Metallics
6825 E. 38th Street
Tulsa, OK 74145-3241
Ph: 918-664-7767
Fax: 918-627-3062

Metallurgical
3100 N. Hemlock Circle
Broken Arrow, OK 74012
Phone: 918-258-6066
Fax: 918-258-1154

LABORATORY REPORT

Attn: Bucky Weaver
The Crosby Group, Inc.
P.O. Box 3128
Tulsa, OK 74101

Report No: 1999110497
Date Received: 11/17/1999
Date Reported: 11/19/1999
P.O. No: M9907317

Description: Pic Code - Y5L, 320 - AN 7 Ton Eye Hook API2C, WO# 220156, P/N : 8009916

Room Temperature Tensile Test (ASTM E 8-98), Longitudinal

<u>Parameter</u>	<u>Result</u>
Diameter, in.	.3570
Tensile Strength, psi	119,000
Yield Strength, psi by 0.2% offset	97,300
% Elongation, in 1.4"	21
Reduction of Area, %	67

Hardness, ASTM E 18-97a

Location	Result
4/5 RADIUS	HRC 22.0, 21.0, 21.5

Approved by: _____

Larry G. Pate
Larry Pate, Manager of Mechanical Testing
Sherry Laboratories Midstates

Test results relate only to the items tested. This document shall not be reproduced, except in full, without the written approval of Sherry Laboratories Midstates. The recording of false, fictitious, or fraudulent statements or entries on this document may be a punishable offense under federal and state law.



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Impact Test Report

Style and Model of Machine:	SATEC, SI-1K3
Available Impact Energy:	300 Ft-Lbs.
Impact Velocity:	17 Ft/Sec.
Method of Test:	SA-370/ASTM-E23
Specimen Type:	Charpy "V" Notch
Specimen Location:	ASTM-A370 Longitudinal
Notch Orientation:	Perpendicular to Surface
Specimen Size:	10mm X 10mm
Test Temperature:	-40 °F

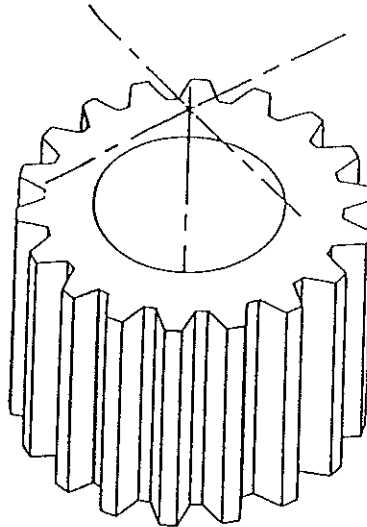
Notch Location:	Base
Impact Values (Ft-Lbs.):	56, 61, 53
Lateral Expansion(Mils):	44, 39, 35
Shear(%):	75, 80, 70

Approved by: Larry G. Pate
Larry Pate, Manager of Mechanical Testing
Sherry Laboratories Midstates

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BACKLASH CERTIFICATES

NO.: NES194-046
 REV.:
 APPR: *BK*
 DATE: 12/13/01



BACKLASH REPORT

PINION/BALLRING

CRANE SERIAL NUMBER: 020209

BACKLASH TOP: .024 BOTTOM: .024

ALIGNMENT

X1 $1\frac{1}{32}$ "	X2 $1\frac{1}{32}$ "	L $8\frac{3}{4}$ "	SLOPE X = $\frac{X2-X1}{L}$ =	<u>0</u>
Y1 $1\frac{1}{32}$ "	Y2 $1\frac{1}{32}$ "	L $8\frac{3}{4}$ "	SLOPE Y = $\frac{Y2-Y1}{L}$ =	<u>0</u>

ARE BOLTS (TURRET OR UPPERSTRUCTURE/ BALLRING) IN PLACE? ☒ YES ☐ NO

DATE: 5/24/02

ACCEPTABLE: *Timothy J. Mollere*

NOT ACCEPTABLE: _____

MISCELLANEOUS

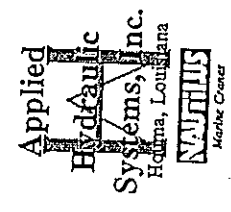
NO.: NES194-040
REV.:
APPR: P.T.
DATE: 12/12/01

Certificate of Leak Test

Vessel Description: Return Manifold
Applied Hydraulic Systems, Inc. Work Order Number: 020209
Test Pressure (PSIG): 45 MPa
Test Date: 5/31/02

It is hereby certified that:

- The referenced vessel has been pressure tested to the recorded value in accordance with NES184-051 Vessel Leak Test work instruction (bubble method).
- The test has proven the vessel to be free of leaks.
- The test was performed correctly and it is accurately recorded.



Samuel J. Muller
Quality Inspector

NO.: NES194-040
REV.:
APPR: P.F.
DATE: 12/12/01

Certificate of Leak Test

Applied Hydraulic Systems, Inc. Vessel Description: Power Unit
Work Order Number: 020209
Test Pressure (PSIG): 2 1/2 Ma.
Test Date: 6/3/02

It is hereby certified that:

- The referenced vessel has been pressure tested to the recorded value in accordance with NES184-051 Vessel Leak Test work instruction (bubble method).
- The test has proven the vessel to be free of leaks.
- The test was performed correctly and it is accurately recorded.

Applied
Hydraulic
Systems, Inc.
Houma, Louisiana
NAUTIS
Marine Crane

Samuel Mullere
Quality Inspector

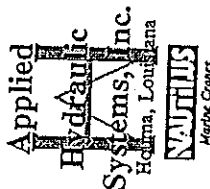
No.: NES194-040
REV.:
APPR: *RT*
DATE: 12/12/01

Certificate of Leak Test

Applied Hydraulic Systems, Inc. Vessel Description: *Return piping*
Work Order Number: *020209*
Test Pressure (PSIG): *45 lbs.*
Test Date: *6/3/02*

It is hereby certified that:

- The referenced vessel has been pressure tested to the recorded value in accordance with NES184-051 Vessel Leak Test work instruction (bubble method).
- The test has proven the vessel to be free of leaks.
- The test was performed correctly and it is accurately recorded.



Sam J. Mallone
Quality Inspector

NO.: NES194-040
REV.:
APPR: 22
DATE: 12/12/01

Certificate of Leak Test

Applied Hydraulic Systems, Inc. Vessel Description: Auction Tank 2-6" 2-4"
Work Order Number: 020209
Test Pressure (PSIG): 2 1/2 P.S.I.
Test Date: 5/23/02

It is hereby certified that:

- The referenced vessel has been pressure tested to the recorded value in accordance with NES184-051 Vessel Leak Test work instruction (bubble method).
- The test has proven the vessel to be free of leaks.
- The test was performed correctly and it is accurately recorded.

Applied
Hydraulic
Systems, Inc.
Houma, Louisiana
NAUTIS
Marine Center

Anne J. Moller
Quality Inspector

NO.: NES194-041
 REV.:
 APPR: *[Signature]*
 DATE: 12/12/01

020209 Pemex 180B-60

[illegible]

4-6 mls

2-3 mls

TOTAL MILLAGE: 6-9