Traction Winch System

Installation, Operation and Maintenance Manual

Prepared for

Texas A&M University
Offshore Technology Research Center

Major System Components

Traction Winch
Storage Winch
Levelwind
Diesel-Hydraulic Power System

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EMPTY WT 6450 #
GROSS WT 7300 #

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Job No. 424/425
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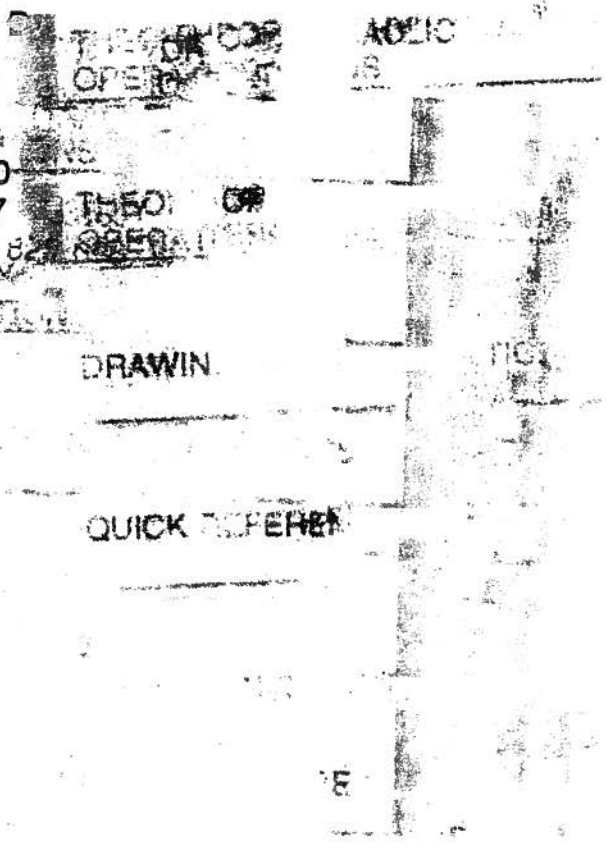

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Section 1

Section 1 - INTRODUCTION

1.1 Section Highlights

This manual is divided into 12 sections, each of which is marked with a tabbed divider and numbered according to section for easy reference.

Section

1 Introduction summarizes the contents and use of the manual.

2 Index of Tables provides an indexed list of page references to all tables contained in the manual.

3 System Description provides a general description of the function and principal components of the Traction Winch System.

4 Shipping Configuration, Installation and Start-Up provides the procedures and recommended hardware required for installing the Traction Winch System in preparation for start-up and operation.

5 Operation provides system operating procedures, illustrations and descriptions of all controls and indicators.

6 Maintenance provides procedures for scheduled and preventive maintenance as well as the manufacturer's recommendations for maintenance materials.

7 Troubleshooting provides procedures to perform electrical and hydraulic troubleshooting of the Traction Winch System.

8 Theory of Hydraulic Operations provides a description of the Traction Winch Hydraulic System and its operation.

9 Theory of Electrical Operations provides a description of the Traction Winch Electrical System and its operation.

10 Schematics and Drawings provides general assembly drawings as well as related hydraulic/electrical schematics and control panel drawings.

11 Quick Reference Data provides Traction Winch System ratings and component weights.

12 Component Support Literature refers to manufacturers component literature provided for those parts identified on the corresponding hydraulic/electrical schematic.

1.2 Organization and Use of This Manual

This manual was designed for technicians/operators with prior experience in the use of cable handling systems. The manual contains a complete description of the traction winch system as well as installation procedures, operating instructions, maintenance/repair information, and troubleshooting guidelines.

1.3 Safety Awareness Prompts

The manual prompts safety awareness when deemed necessary for a particular application or situation. These prompts are reflected in descending order of significance as shown below:

WARNING

WARNING identifies a situation which is potentially lethal or hazardous to personnel.

CAUTION

CAUTION identifies a situation which is potentially hazardous to equipment or material.

NOTE

NOTE amplifies or emphasizes information provided in text or procedures.

1.4 Manual Changes and Control

In the event that DYNACON, Inc. issues a change to the manual, the user will be notified of such change in a written bulletin. Each change shall be assigned a change number and date of issue (DOI) for purposes of record keeping. The actual change in text will be reflected in bold print and the entire page or pages on which the change occurred shall be provided. Changed pages will reflect the new date of issue and may be inserted in place of the current page which may then be discarded. The user is responsible for the implementation, documentation and operating results of any changes to the manual not initiated and/or approved by DYNACON, Inc. In addition, the user is responsible for establishing document control and access.

Section 2

Section 2 - INDEX OF TABLES

2.1 Index of Tables

Section 3

Section 3 - SYSTEM DESCRIPTION

3.1 Traction Winch System Overview

The DYNACON, Inc. Traction Winch System is a cable handling system designed to deploy, tend, recover, and store up to 36,000 feet of 0.680 inch diameter armored cable.

The Traction Winch System performs all pulling and storage functions associated with the cable. Principal components in the Traction Winch System include a traction winch, levelwind, storage winch, and related diesel-hydraulic power system.

3.1.1 Traction Winch

The traction winch is the principal cable pulling component in the Traction Winch System. The traction winch bears the entire payload and cable weight under high line tension throughout the operational cycle.

Principal components of the traction winch include two 60-inch nominal root diameter grooved traction sheaves within a frame assembly. Each traction winch sheave is independently driven by an axial piston hydraulic motor and planetary gearbox. Each traction winch sheave is equipped with a spring applied, hydraulically released failsafe brake mounted between the respective hydraulic motor and gearbox.

3.1.2 Storage Winch

The storage winch stores up to 36,000 feet of cable under low line tension.

Principal components of the storage winch include a 36 inch diameter grooved drum core to accommodate 0.680 inch diameter cable. The storage winch drum is supported within a base frame on each end by a pillow block bearing assembly constructed to accommodate a drum shaft extending through the entire length of the drum. Internal support and air cooling is provided to the drum core and drum shaft with two internal baffles. Additional internal support to the drum core is also provided by the winch drum drive plate and an end plate. The drum shaft features an inside diameter equal to 5.75 inches to accommodate a customer-supplied slip ring. The drum is driven on one end by a winch drive assembly consisting of a hydraulic motor, sprocket and roller chain. The output shaft of the hydraulic motor drives a 17 tooth, No. 100 sprocket which transmits power via No. 100 roller chain to drive a 70 tooth, No. 100 sprocket attached to the winch drum drive plate. The storage winch is equipped with two spring applied, hydraulically released caliper brakes acting on a brake disc mounted to the winch drum drive plate.

Four point lifting of the storage winch is provided by a lifting eye attached to each corner of the storage winch base frame.

3.1.3 **Levelwind**

The levelwind assembly is aligned with and bolted to the storage winch and ensures that the cable is properly aligned and stacked as it enters or exits the storage winch drum.

Principal components of the levelwind include a base frame, two nickel-plated guide tubes, support plates, and a carriage assembly containing a 36.92-inch root diameter sheave that fairleads the cable between the storage winch and the traction winch. The levelwind carriage sheave assembly is driven across the entire length of the guide bars by a hydraulic motor turning an ACME screw through an ACME nut attached to the carriage assembly. A hydraulic cylinder mounted beneath the levelwind sheave provides counter-balance pressure to maintain the levelwind sheave at a proper angle relative to the storage winch drum as the cable layer level on the storage winch increases or decreases, eliminating cable chafing.

3.1.4 **Diesel-Hydraulic Power System**

The Diesel-Hydraulic Power System provides a source of power to the traction winch system.

The Traction Winch System is equipped with a 155 HP diesel engine attached to a hydraulic pump string assembly that provides oil flow to drive hydraulic motors which power the traction winch, storage winch and levelwind. The hydraulic pump string assembly is attached to the diesel engine with an adaptor followed by the traction winch pump, storage winch pump and levelwind pump. The traction winch and storage winch pumps provide oil flow to the traction winch and storage winch hydraulic motors, respectively, through a closed loop circuit. The levelwind pump provides oil flow to the levelwind hydraulic motor through an open loop circuit.

In addition to the diesel engine and pump assembly, the power unit includes fluid/fuel reservoirs and associated gauges. The power unit frame is constructed of rectangular tubing which incorporates four lifting eyes located on top of the framework. All components and enclosures mounted on the power unit are protected by a square tubing framework. Removable panel doors enclose the power unit.

A hydraulic reservoir is mounted in a bolt-on frame above the pump assembly. Hydraulic oil filters are mounted on the side wall of the reservoir and are hard plumbed to the internal piping of the reservoir. A diesel fuel reservoir is bolted into the power unit framework above the diesel engine. A gauge panel is mounted on the power unit to facilitate pump pressure monitoring. A seawater over oil heat exchanger is mounted within the base frame of the power unit enclosure.

Section 4

Section 4 - Shipping Configuration, Installation and Start-Up

4.1 Shipping Configuration

The Traction Winch System components and related assemblies are shipped as independent units according to the configuration listed below.

4.1.1.1	Traction Winch
4.1.1.2	Storage Winch
4.1.1.3	Levelwind
4.1.1.4	Diesel-Hydraulic Power Unit

4.2 Installation

4.2.1 Overview

The Traction Winch System is installed in a working area determined by the customer and is prepared for operation by accomplishing three principal tasks:

- choose the desired component layout configuration, lift the components from their shipping platform and secure the components to the deck.

- complete all required hydraulic system connections and related start-up procedures.

- complete all required electrical system connections and related start-up procedures.

The Traction Winch System installation procedures should be accomplished for each system component according to the checklists that follow.

4.2.2 Deck Installation Checklist - Traction Winch System Components

CAUTION

Consideration should be given to proper weight distribution of the system relative to the ship's center of buoyancy, center of flotation and center of gravity.

Prior to placing the system components on the ship's deck, a layout configuration for the system should be determined that will not have an adverse effect on the above-referenced forces. Failure to do so could have a negative impact on ship stability. (Refer to Section 11, item 11.2, page 11-1, "Quick Reference Data - Traction Winch System Component Weights and Dimensions.")

The crane and/or hoist apparatus used to place the system components on the deck should have a lifting capacity rating sufficient to lift each component in accordance with operational requirements. Refer to Section 11, item 11.2, page 11-1, "Quick Reference Data - Traction Winch System Component Weights and Dimensions" for component weights and footprint dimensions.

NOTE

A lifting sling unique to the system components is not provided. Lifting devices and procedures used to place the system components onto the ship's deck should be in accordance with operational requirements.

It is recommended that a spreader bar be used with hoist apparatus when lifting the storage winch in order to prevent lift lines from contacting and possibly damaging flange surface areas. In the event a spreader bar is not available it is recommended that protective padding be placed over the flange surface areas that may make contact with the lift lines during hoist operations.

Prior to lifting the system components and placing them on the ship's deck, it may be desirable to attach control lines to each corner of the component frame to provide a greater degree of handling control and accurate positioning. Control lines should be of sufficient length to allow handlers to remain clear of the component. Refer to Section 4, Table 4.2.2, page 4-5, "Deck Installation - Recommended Parts and Specifications" for component lifting and installation data.

[1] Attach a lifting sling and/or spreader bar assembly to the desired component base frame.

[1.a.] Connect a hoist/crane lifting hook to the lifting sling and/or spreader bar.

[1.b.] Position the assembly over the top of the component frame. Lower the assembly to a level that will permit lift lines to be connected to the each lifting eye.

[1.c.] Connect the lift lines to the corresponding lifting eyes on the component frame.

WARNING

Personnel should stand clear of system components during hoist operations.

[2] Slowly raise the lifting sling and/or spreader bar assembly until the wire rope legs become taut and all slack is removed.

[3] Lift the component winch several inches off the shipping surface and check the integrity of all lifting lines and connections.

[4] Position and place the component onto the ship's deck in the desired position.

NOTE

It is recommended that lifting apparatus remain attached until components are secured to the ship's deck. The following procedures list the steps required to secure system components to the ship's deck by bolting them to previously installed customer supplied deck plates utilizing the recommended parts listed in Table 4.2.2, "Deck Installation - Recommended Parts and Specifications, Section 4, page 4-5."

CAUTION

Each component frame base is equipped with mounting eyes through which hex head screws are inserted in order to secure the component to the ship's deck plates. All mounting eyes must be used to ensure that each component is properly secured to the ship's deck. Failure to use all mounting eyes could result in damage to the components and/or ship's deck due to torque generated by Traction Winch System operations.

It is recommended that hex head screws used for securing component frames to deck plates have a minimum shaft length sufficient to allow for washer thickness, deck plate thickness and a minimum of 1 inch thread engagement.

CAUTION

Excessive bolt length could damage insert sealing cap, allowing moisture to enter frame tubing.

[5] Secure the desired component frame to the ship's deck plates according to the following steps:

[5.a.] Place a lock washer and flat washer onto the shaft of a hex head screw. ____

[5.b.] Insert a hex head screw with washers into each mounting eye and tighten according to torque requirements illustrated in Table 4.2.2 , "Deck Installation - Recommended Parts and Specifications", Section 4, page 4-5. ____

[6] Lower the lifting sling and/or spreader bar assembly until the rope legs become slack. ____

[7] Disconnect the lift lines from each lifting eye. ____

[8] Move the lifting sling and/or spreader bar assembly away from the component. Store the lifting sling and/or spreader bar assembly according to operational requirements. ____

Table 4.2.2
Deck Installation
Recommended Parts and Specifications*

	Traction Winch	Storage Winch	Levelwind**	Diesel-Hydraulic Power Unit
Number of Lift Points	1	4	4	4
Number of Bolt-Down Mounting Installation Holes & No. Hex Head Screws Required	12	14	8	6
Required No. SS Lock Washers	12	14	8	6
Required No. SS Flat Washers	12	14	8	6
Recommended Screw Type	Hex	Hex	Hex	Hex
Description	1" -8UNC	1" -8UNC	3/4" -10UNC	3/4" -10UNC
Grade	5 or better Zinc Coated	5 or better Zinc Coated	5 or better Zinc Coated	5 or better Zinc Coated
Torque Level (Dry)	640ft/lbs	640ft/lbs	260ft/lbs	260ft/lbs
Torque Level (Lubricated)	480/lbs	480/lbs	200/lbs	200/lbs

Notes:* Refer to Section 11, page 11-1, "Quick Reference Data" for system component weights and footprint dimensions.

** Two mounting pads with installation eyes found at the front of the levelwind are used to properly align and attach the Levelwind to the Storage Winch. These mounting pads may also be used as two of the four lifting points located on the levelwind frame. Refer to Drawing No. 424-0000-01, "Storage Winch/Levelwind General Arrangement" and Drawing No. 424-2001-02, "Levelwind General Assembly" for an illustration of component configuration and installation.

4.3 Electrical Connections

1. The electrical connections shown in the following table must be completed prior to start-up and operation of the Traction Winch System. Each connection is labeled according to the following table:

Connector Origin	Label	Connect To	Connector Destination	Label	
Local Control Enclosure	P1		DHPU	J1	____
Local Control Enclosure	P2		DHPU	J2	____
Remote Control Enclosure	P3		DHPU	J3	____
Levelwind Enclosure	P4		DHPU	J4	____

2. Connect lead wires to the battery terminals found on the battery located in the Diesel-Hydraulic Power Unit. ____

4.4 Hydraulic Connections and Initial Pressure Settings

4.4.1 Hydraulic Connections

[1] The following table illustrates all system hydraulic connections that must be completed prior to startup and operation. Each hose origin and corresponding destination are provided with identical labels as shown below:

HOSE ORIGIN	LABEL	HOSE DESTINATION
Traction Winch	TW A	Diesel-Hydraulic Power Unit
Traction Winch	TW B	Diesel-Hydraulic Power Unit
Traction Winch	TW Case	Diesel-Hydraulic Power Unit
Traction Winch	TW Brake	Diesel-Hydraulic Power Unit
Storage Winch	SW A	Diesel-Hydraulic Power Unit
Storage Winch	SW B	Diesel-Hydraulic Power Unit
Storage Winch	SW Case	Diesel-Hydraulic Power Unit
Levelwind	Levelwind Pressure	Diesel-Hydraulic Power Unit
Levelwind	Levelwind Return	Diesel-Hydraulic Power Unit
Levelwind	SW Brake	Storage Winch Brake

Table 4.4.1
Traction Winch System Hydraulic Connections

[2] Connect a water-in line to the intake port (labeled "Water-In") of the heat exchanger located in the base of the Diesel-Hydraulic Power Unit frame.

[3] Connect a water-out line to the discharge port (labeled "Water-Out") of the heat exchanger located in the base of the Diesel Hydraulic Power Unit frame.

4.4.2 Initial Pressure Settings

Refer to Section 10, Drawing No. 425-8001-01, "Traction Winch System Hydraulic Schematic", Drawing No. 425-8009-02, "Traction Winch System Flow Line Schedule", Drawing No. 424-8001-01, "Levelwind/Storage Winch Hydraulic Schematic" and Drawing No. 424-8009-02, "Levelwind/Storage Winch Flow Line Schedule" for hydraulic system initial pressure settings.

Section 5

Section 5 - OPERATION

5.1 Traction Winch System - Controls and Indicators

5.1.1 Local Control Enclosure - Controls

- **HPU Stop Pushbutton** - (Not Provided) Stops the Traction Winch System Diesel-Hydraulic Power Unit and all Traction Winch System functions.

- **Mode Select Switch** - Place switch to AUTOMATIC - places storage winch into AUTOMATIC mode of operation. Place switch to MANUAL - places storage winch into MANUAL mode of operation. (Refer to Section 5, item 5.2, page 5-4, "Traction Winch System Operation" for procedures in selecting mode of operation.)

- **Storage Winch PAYOUT/HAUL-IN (Joystick)** - The storage winch control handle is used concurrently in the setup mode with the traction winch control handle to pay out and haul in cable. When the control handle is in the neutral position (center), the storage winch brake is set. When the control handle is moved out of neutral to the PAY OUT position, cable is paid out. When the control handle is moved to the HAUL IN position, cable is hauled in.

- **Traction Winch PAYOUT/HAUL-IN (Joystick)** - The traction winch control handle is used concurrently in the setup mode with the storage winch control handle to pay out and haul in cable. When the control handle is in the neutral position (center), the traction winch brakes are set. When the control handle is moved out of neutral to the PAY OUT position, both the traction winch brakes and the storage winch brake are released and cable is paid out. When a control handle is moved to the HAUL IN position, cable is hauled in.

- **Remote Control Enable/Disable Toggle Switch** - Place switch to ENABLE - enables remote control station. Place switch to DISABLE - disables remote control station. The remote station will be automatically disabled if the Traction Winch control handle on the Local Control Panel is moved out of the center (neutral) position. **The Traction Winch System must be in the AUTOMATIC mode of operation in order to enable the remote control station.**

5.1.2 Local Control Enclosure - Indicators

- **Traction Winch Brake Released**
  Illuminated when the traction winch brakes are released by moving the traction winch control handle out of the center (neutral) position.

- **Proof-of-Tension**
  Illuminated when sufficient line tension has been generated by the storage winch to allow proper spooling of cable in the automatic mode. **This indicator must be illuminated before the storage winch can be placed into automatic mode.**

- **Automatic Enabled**
  Illuminated when the storage winch automatic mode has been enabled. **This indicator must be illuminated before the remote control station can be enabled.**

- **Oil Pressure/Coolant Temperature Warning**
  Illuminated when **diesel engine** oil pressure and/or coolant temperature does not meet acceptable operating specifications. Refer to engine specifications section of the diesel engine operation and maintenance manual for acceptable operating parameters.

- **Remote Enabled**
  Illuminated when the remote control station is enabled.

- **Line Data Display**
  Provides a digital display of cable length actively deployed, expressed in total meters, and cable deployment/recovery speed expressed in meters per minute.

5.1.3 Remote Control Panel - Controls

- **HPU STOP Pushbutton (Not Provided)**
  Stops the Traction Winch System Diesel-Hydraulic Power Unit and all Traction Winch System functions.

- **Traction Winch PAYOUT/HAUL-IN (Joystick)**
  When the control handle is in the neutral position (center), the traction winch brakes are set. When the control handle is moved out of neutral to the PAY OUT position, the traction winch brakes and the storage winch brake are released and cable is paid out. When the control handle is moved to the HAUL IN position, cable is hauled in.

5.1.4 Remote Control Panel - Indicators

- **Traction Winch Brake Released**
  Illuminated when the traction winch brakes are released by moving the traction winch control handle out of the center (neutral) position.

- **Remote Enabled**
  Illuminated when the remote control station is enabled.

- **Line Data Display**

Provides a digital display of cable length actively deployed, expressed in total meters, and cable deployment/recovery speed expressed in meters per minute.

- **Oil Pressure/Coolant Temperature Warning**
  Illuminated when **diesel engine** oil pressure and/or coolant temperature does not meet acceptable operating specifications. Refer to engine specifications section of the diesel engine operation and maintenance manual for acceptable operating parameters.

5.1.5 Traction Winch System Gauge Panel - Indicators

The Traction Winch System Gauge Panel monitors all system pressure, charge pressure and supply pressure levels. The panel is mounted on the Diesel-Hydraulic Power Unit Frame and consists of the following gauges:

- **Traction Winch System Pressure A**
- **Traction Winch System Pressure B**
- **Traction Winch Charge Pressure**
- **Open Loop Supply Pressure**
- **Storage Winch System Pressure A**
- **Storage Winch System Pressure B**
- **Storage Winch Charge Pressure**

5.1.6 Hydraulic Power Unit Starter Panel - Controls

- **Start Pushbuttons:** (2) - When depressed, starts the Diesel-Hydraulic Power Unit.
- **Stop Pushbutton (Not Provided)** - Stops the Diesel-Hydraulic Power Unit.

5.1.7 Levelwind Control Enclosure - Controls

- **Levelwind Corrector Pushbuttons** - Provides manual operation and movement of the Levelwind Carriage Assembly. Choose the pushbutton corresponding to the desired direction of movement as indicated by arrows on the Levelwind Control Panel. Hold the pushbutton down until carriage assembly reaches desired position, then release.

5.2 Traction Winch System Operation

CAUTION

Prior to operation of the Traction Winch System, all installation procedures, hydraulic connections and electrical connections **must** be completed for the entire system.

Prior to start-up and operation of the Traction Winch System, ensure that personnel remain clear of traction winch sheaves and cable path.

[1] Start the Traction Winch System hydraulic power unit by depressing both START pushbuttons located on the Diesel Hydraulic Power Unit Starter Panel. _____

NOTE

The Traction Winch System and operational functions may be stopped at any time during the following procedures by pulling the manual shutdown knob located on the Diesel-Hydraulic Power Unit.

[2] Verify **minimum** acceptable hydraulic system pressure levels. _____

(Refer to Drawing No. 425-8001-01, "Traction Winch System Hydraulic Schematic", Drawing No. 425-8009-02, "Traction Winch System Flow Line Schedule", Drawing No. 424-8001-01, "Levelwind/Storage Winch Hydraulic Schematic", and Drawing No. 424-8009-02, "Levelwind/Storage Winch Flow Line Schedule" for hydraulic system connections and hydraulic system initial pressure settings.)

NOTE

(Following start-up as required in steps 1-2 above, the system is now in MANUAL mode of operation.

The Storage Winch may be operated in MANUAL mode or in AUTOMATIC mode.

MANUAL mode is used for reeving cable through the system and is the default mode entered upon system startup. While in the

MANUAL mode, the storage winch and traction winch may be independently operated.

AUTOMATIC mode is used for normal Traction Winch System operations. While in the AUTOMATIC mode, the entire system, to include the traction winch and storage winch, is controlled by the traction winch control joystick. Independent manipulation of the storage winch control joystick is not necessary while in AUTOMATIC mode.

Refer to steps 3 through 7 for AUTOMATIC mode of operation.

The Traction Winch System may be operated from a local or remote control station. The system may be operated from a remote control station by placing the Remote Control Enable switch on the Local Control Enclosure to the ENABLE position. **Prior to placing the remote control stations in the enabled mode, the Traction Winch PAY-OUT/HAUL-IN joystick found on the remote control station should be placed in the neutral position and the system must be placed in automatic mode.**

To Enter Automatic Mode of Operation

[3] **Ease** the **storage winch control handle** to the HAUL-IN position until slack in the cable is removed between the storage winch and the traction winch. _____

[4] Verify that the PROOF OF TENSION indicator is illuminated. _____

[5] **While holding** the storage winch control joystick in the HAUL-IN position and maintaining cable tension between the traction winch and storage winch, place the MODE SELECT switch to the AUTOMATIC position. _____

[6] Verify that the AUTOMATIC MODE ENABLED indicator is illuminated. _____

[7] Return the storage winch control joystick to the neutral position and release the MODE SELECT switch. _____

NOTE

The Storage Winch is now in AUTOMATIC mode and is controlled solely with the traction winch control joystick. Manipulation of the storage winch control joystick is not required while in AUTOMATIC mode. The remote control station may be enabled only if the system is in AUTOMATIC mode of operation.

[8] **To return the system to MANUAL mode of operation, accomplish step 8a., 8b. <u>OR</u> 8c. as follows:**

[8.a] Place MODE SELECT switch to MANUAL. _____

<u>OR</u>

[8.b] Move the storage winch control joystick out of the neutral position. _____

<u>OR</u>

[8.c] Accomplish system shutdown by pulling the manual shutdown knob located on the Diesel-Hydraulic Power Unit. The system will, upon restoration of power, default to manual mode.

Section 6

Section 6 - MAINTENANCE

6.1 Overview

This section includes the following categories:

- Scheduled Maintenance
- Maintenance Procedures
- Preventive Maintenance
- Recommended Lubricants

6.2 Scheduled Maintenance - Traction Winch System

Maintenance for Traction Winch System components is reflected in Tables 6.2.1 through 6.5.1 according to the following key:

D - Daily

W - Weekly

M - Monthly

Q - Quarterly

S - Semi-Annually

A - Annually

Unit Name	Maintenance Schedule					
Storage Winch	D	W	M	Q	S	A
Gear Box Oil Level		X				
Grease Drum Support Bearings			X			
Inspect Bolt Tightness on Winch Frame Deck Plates			X			

Table 6.2.1: Storage Winch Maintenance Schedule

Unit Name	Maintenance Schedule					
Traction Winch	D	W	M	Q	S	A
Grease Traction Sheave Shaft Support Bearings			X			
Check/Fill Traction Winch Drive Gear Oil Level. Check for Leaks Daily. Change After First 200 Hours. Further Oil Change at Approximate 2000 Hour Intervals.			X			
Inspect Bolt Tightness on Winch Frame Deck Plates			X			

Table 6.2.2: Traction Winch Maintenance Schedule

Unit Name	Maintenance Schedule					
Levelwind	D	W	M	Q	S	A
Grease Levelwind Guide Bars		X				
Grease Levelwind ACME Screw		X				
Inspect Levelwind Sheave Bearings		X				
Grease Sheave Pivot Pin		X				
Grease ACME Screw Support Bearing			X			
Inspect Levelwind Follower Arm for Wear			X			
Inspect Bolt Tightness on Levelwind Frame Deck Plates			X			
Inspect ACME Nut for Wear			X			

Table 6.2.3: Levelwind Maintenance Schedule

Unit Name	Maintenance Schedule					
Power Unit	D	W	M	Q	S	A
Check Hydraulic Oil Level.	X					
Change Charge Pressure Hydraulic Filter Elements				X		
Change Return Filter Elements				X		
Change Hydraulic Oil. Test Oil Regularly and Change if Contaminated. Flush Entire System and Replace Filters at Same Time Fluid is Changed.						X
Checks for Hydraulic Oil Leaks	X					

Table 6.2.4: Power Unit Maintenance Schedule

6.3 Maintenance Procedures

Maintenance procedures for the traction winch system are described in the following sections.

6.3.1 Grease Fittings

Grease fittings are installed for those bearings which require periodic lubrication. Periodic greasing removes dirt, dust, splash water, condensation, and other contaminants.

Grease packing seals the bearing, reduces friction, and protects against corrosion. Table 6.5.1 lists the lubricants recommended for use with the Traction Winch System. The following sections provide procedures for greasing system equipment.

6.3.1.1 Levelwind Guide Bars

Grease the guide bars according to the following procedures:

[1] Attach a grease gun nozzle to the grease fitting located on the levelwind carriage.

[2] Pump grease into fitting.

[3] Stop when a surplus of grease appears on the levelwind carriage.

[4] Apply a thin coat of grease along the entire length of the guide bars.

6.3.1.2 Levelwind ACME Screw

Grease the ACME screw by applying a thin coat of grease to the outside diameter of the screw along its entire length.

6.3.1.3 Levelwind Sheave Bearings

Grease the levelwind sheave bearings according to the following procedures:

[1] Attach a grease gun nozzle to the grease fitting on the sheave axle retaining bolt.

[2] Pump grease into fitting.

[3] Stop when a surplus of grease appears around the sheave axle spacer plates.

6.3.2 High Pressure Filter on the Levelwind

The high pressure filter removes undesirable elements from oil supplied to the servo-valve manifold. If the levelwind becomes sluggish or stops, replace the filter element.

6.4 Preventive Maintenance

Preventive Maintenance for the Levelwind ACME Nut is summarized in Table 6.4.1.

Unit Name	Maintenance Schedule					
Levelwind ACME Nut	D	W	M	Q	S	A
Check ACME Nut for Wear			X			

Table 6.4.1: Levelwind Acme Nut Maintenance Schedule

6.4.1 Levelwind ACME Nut

The Levelwind System has a primary and secondary ACME nut. The primary ACME nut drives the Carriage Assembly and the secondary ACME Nut bears no load. The primary ACME nut is bolted to the Carriage Assembly on the overboarding side. The secondary ACME Nut Assembly is located on the opposite side of the carriage.

During the assembly stage, the primary ACME nut assembly is attached to the carriage. Slack is removed by pushing or pulling the carriage to the primary nut. The secondary nut is moved to the carriage, backed off until the first bolt hole position lines up, then secured. The space on the sides of the secondary nut allows it to ride free during operation.

In order to monitor wear on the primary ACME nut, measure the distance between the secondary ACME nut and carriage assembly before any wear occurs on the primary ACME nut. Record the measured value. Thread wear on the primary nut causes this distance to increase. When the measured gap reaches the initial measured value plus 1/16 inch, the primary nut should be replaced.

If no initial measurement between the secondary ACME nut and the carriage assembly was made or recorded, use the following alternate approach.
Alternate method: Loosen the bolts holding the primary nut to the Carriage Assembly and push the nut away from the Carriage Assembly. Measure the gap when it reaches its maximum distance. Then push the nut back toward the Carriage Assembly and measure the gap again. Normal tolerance between the nut and the screw is approximately 1-2 thousandths. When the difference between the two measurements exceeds 1/16 inch, excessive wear has occurred and the nut should be replaced.

6.5 Recommended Lubricants and Traction Winch System Upper Case Drain Locations

Lubricant	Use	Type
Grease	Grease Fittings	MYSTIK JT-6 or Equivalent MIL-G-81322D
Hydraulic Fluid	Hydraulic System	Texaco-Rando HDZ32 Grade HIGH VI Antiwear Product Code 01493 or Equivalent
Gear Oil	Gearbox	Chevron 80W-90

Table 6.5.1: Recommended Lubricants

	Total Number of Upper Case Drains	Location
Pump Upper Case Drain	3	(1) Top of Traction Winch Pump in Power Unit (2) Top of Storage Winch Pump in Power Unit (3) Top of Levelwind Pump in Power Unit
Motor Upper Case Drain	3	(1) Outside center of Traction Winch Hydraulic Motor No.1 (2) Outside center of Traction Winch Hydraulic Motor No.2 (3) Inside top of Storage Winch Motor

Table 6.5.2: Traction Winch System - Upper Case Drain Locations

6.6 Surface Preparation and Paint Configuration

Surface Preparation	White blast to base metal with 16-509 copper slag abrasive.		
	Type	**Solvent**	**Color Code**
	AMERON INORGANIC ZINC DIMETCOTE 21-5 WATER BASED	**N/A**	**N/A**
	Type	**Solvent**	**Color Code**
Mid Coat	International KHA-3021062 Intertuff Epoxy	International 415 Thinner	Light Gray
	Type	**Solvent**	**Color Code**
Top Coat	International Interguard FZ A004 Modified Epoxy	International 415 Thinner	White
	Primer	**Mid Coat**	**Top Coat**
Film Thickness	2-3 Mils Dry	5-6 Mils Dry	2-3 Mils Dry
	Primer	**Mid Coat**	**Top Coat**
Elapsed Time Before Applying	N/A	2 Hours after applying primer	50°F - 16 hrs after applying mid coat 73°F - 6 hrs after applying mid coat 95°F - 4 hrs after applying mid coat

Table 6.6.1 Surface Preparation and Paint Configuration

6.7 Adding System Hydraulic Fluid After Draining System

Complete the following steps when adding system hydraulic fluid after draining system:

[1] Remove **upper** case drain fittings at the locations reflected in Table 6.5.2, "Traction Winch System - Upper Case Drain Locations", page 6-9. ____

[2] Remove dirt, grease or other contaminants from the surface areas surrounding the upper case drain openings and from the upper case drain fittings. ____

[3] Fill pump and motor cases through the **upper** case drain openings with hydraulic fluid provided with the system according to Table 6.5.1, "Recommended Lubricants - Traction Winch" page 6-9. It is recommended that all hydraulic fluid be passed through a 10 micron filter. ____

[4] Reinstall and tighten case drain lines and tighten all fittings where required. ____

[5] Loosen suction lines at the respective pump inlet. ____

[6] Using a 10 micron filter cart, fill the power unit reservoir until fluid reaches the loosened hoses at the respective pump inlet(s). Tighten the hoses and continue filling the reservoir, ensuring that reservoir fluid level has reached the "HIGH" mark on the applicable sight level gauge. ____

[7] Re-check pump and motor case fluid levels. ____

Section 7

Section 7 - TROUBLESHOOTING

7.1 Overview

Troubleshooting instructions for the Traction Winch System are detailed in Tables 7.2 through 7.6. This section is designed for technicians who are qualified to perform electrical and hydraulic troubleshooting.

Technicians should be familiar with the overall operation of the Traction Winch System and have available schematics and component manufacturer literature.

The following symptoms are addressed in this chapter.

- Traction unit will not turn with the HPU running. System pressure rises when the control handle is moved from the center.
- Traction unit will not turn with the HPU running. System pressure does not rise when the control handle is moved from the center.
- Storage winch will not turn with the HPU running. System pressure rises when the control handle is moved from the center.
- Storage winch will not turn with the HPU running. System pressure does not rise when the control handle is moved from the center.
- Storage winch will not go into AUTOMATIC mode.
- Levelwind problems and adjustments.

SYMPTOM: Traction winch will not turn with DHPU running/system pressure rises when the control handle is moved from the center position

Possible Cause	Diagnostic Action	Corrective Action
Brake may not be releasing	Check the storage winch pump charge pressure (This is the source used to release the brake)	If no pressure present, repair or replace pump.
	Check electrical signal (24 VAC) to the Traction Winch brake release solenoid (Terminals TB1-71 and TB1-72)	If no signal present, refer to electrical schematic
	Verify solenoid is switching. (You should be able to feel pulses with your hand when the solenoid shifts)	If not shifting, repair or replace solenoid.
	Verify brake release pressure is equal to or greater than 200 psi. (Install a pressure gauge at the brake to verify pressure)	If pressure is low, increase pressure at brake pump. Brake releases from charge pump pressure so check this pressure for indications of problems.
Problem may exist in the hydraulic motor	Verify hydraulic motor will rotate. (Remove all loads from the traction winch, then remove hydraulic motor from gearbox and apply hydraulic power to the hydraulic motor to verify this)	If motor will not turn, repair or replace motor.
Problem may exist in gearbox	Verify gearbox will turn. (Remove all loads from the traction winch, then remove hydraulic motor assembly from gearbox to do this)	If gearbox will not turn, repair or replace gearbox
Bad brake		Repair or replace brake

Table 7.2

SYMPTOM: Traction unit will not turn with HPU running/system pressure does not rise when control handle is moved from center position (port pressure remain charge pressure)

Possible Cause	Diagnostic Action	Corrective Action
Traction Winch pump	Verify charge pressure is present	If not present, repair or replace pump
No electrical signal to the traction winch pump displacement controller	Verify current is present at the Traction Winch Electric Displacement Control at Terminals TB1-69 and TB1-70, Remote joystick, and Terminals TB1-67 and TB1-68, Local joystick.	If no current present, refer to electrical schematic

Table 7.3

SYMPTOM: Storage winch will not turn with HPU running/system pressure rises when control handle is moved from center position

Possible Cause	Diagnostic Action	Corrective Action
Brake may not be releasing	Check the levelwind pump pressure (this is the source used to release the brake)	If no pressure present, repair or replace pump.
	Verify brake release pressure is equal to or greater than 300 psi. (Install a pressure gauge at the brake to verify pressure)	If pressure is low, increase pressure at pressure reducing valve on levelwind valve panel. Note: maximum brake pressure must not exceed 1500 psi.
	Check electrical signal to the storage winch brake release solenoid at terminals TB3-27 and TB3-28	If no signal present, refer to electrical schematic
	Verify solenoid is switching. (You should be able to feel pulses with your hand when the solenoid shifts)	If not shifting, repair or replace solenoid.
Problem may exist in the hydraulic motor (brake failure will usually result in the brake failing to hold rather than failing to release)	Verify system pressure with control handle out of neutral position	If motor will not turn, repair or replace motor.
Bad brake	Remove the brake, try to rotate drum as in above procedure	If drum will turn, repair or replace caliper brake
Interference problems on the drum or bearings	If drum will not rotate with the brake removed	Check for interference on drum or bearings

Table 7.4

SYMPTOM: Storage winch will not turn with HPU running/system pressure does not rise when control handle is moved from center position (port pressures remain at charge pressure.)

Possible Cause	Diagnostic Action	Corrective Action
Storage winch pump	Verify charge pressure is present	If not present, repair or replace pump
No electrical signal to the storage winch pump displacement controller	Verify current is present at the Storage Winch Electric Displacement Control at Terminals TB1-73 and TB1-74.	If no current present, refer to electrical schematic

Table 7.5

SYMPTOM: Storage winch will not go into AUTOMATIC mode.

Possible Cause	Diagnostic Action	Corrective Action
Interlocks	Verify that all interlocks from hydraulic power units are satisfied	Refer to the electrical schematic
Improper enable procedure	Check procedure	Move storage winch control handle to haul in slack cable. With the storage winch control handle in the haul in direction, press the **auto** switch to the **enable** position while releasing the control handle

Table 7.6

Section 8

Section 8 - THEORY OF HYDRAULIC OPERATION

8.1 Overview

The Traction Winch System is composed of the following hydraulic system circuits:

- Traction Winch Closed Loop Circuit
- Storage Winch Closed Loop Circuit
- Levelwind Open Loop Circuit

8.2 Traction Winch Closed Loop Circuit

The primary components of the traction winch closed loop circuit include one bi-directional, variable displacement axial piston pump and two variable displacement hydraulic motors.

The bi-directional, variable displacement axial piston pump is driven by a 200 HP diesel engine.

8.2.1 Traction Winch

Upon starting the diesel-hydraulic power unit, oil is drawn from the power unit reservoir through a suction strainer and into a closed loop pump. Hydraulic oil flow then enters a charge pump integral to the closed loop pump. The charge pump supplies hydraulic fluid for the entire traction winch circuit at a pressure equal to approximately 340 psi. Charge pressure for traction winch closed loop pump may be read from a system pressure gauge.

8.2.1.1 Traction Winch Haul-In Circuit

When the traction winch joystick is pulled toward the operator to the haul-in position, the "A" side of closed loop pump is energized. This angles the swashplate of pump to provide pressure up to 4,500 psi and flow up to 66 gpm to the haul-in side of traction winch motors.

Placing the traction winch joystick in the haul-in position also sends an electrical signal to a solenoid valve which allows charge pressure from a traction winch pump to flow through a flow control valve, into and releasing traction winch brakes, which allows the traction winch drum to rotate in the haul-in direction. The haul-in position also energizes a directional control valve on the levelwind panel which allows reduced pressure from the levelwind open loop pump to enter and release the storage winch brake. System pressure from the traction winch pump enters a hot oil shuttle valve to which two pressure gauges (labeled Traction Winch Pressure "A" and Traction Winch Pressure "B") are attached.

Case return from traction winch motors is returned to a return header.

Case return from traction winch pump is returned to a return header and is directed through a heat exchanger and return filter back to tank.

The oil removed by hot oil shuttle valve is returned to a return header and is directed through a heat exchanger and return filter back to tank.

8.2.1.2. Traction Winch Pay-Out Circuit

When the traction winch joystick is pushed away from the operator to the pay-out position, the "B" side of closed loop pump is energized. This angles the swashplate of pump to provide pressure up to 4,500 psi and flow up to 66 gpm to the pay-out side of traction winch motors.

Placing the traction winch joystick in the pay-out position also sends an electrical signal to a solenoid valve which allows charge pressure from a traction winch pump to flow through a flow control valve, into and releasing traction winch brakes, which allows the traction winch drum to rotate in the pay-out direction. The pay-out position also energizes a directional control valve on the levelwind panel which allows reduced pressure from the levelwind open loop pump to enter and release the storage winch brake. System pressure from the traction winch pump enters a hot oil shuttle valve to which two pressure gauges (labeled Traction Winch Pressure "A" and Traction Winch Pressure "B") are attached.

Case return from traction winch motors is returned to a return header.

Case return from traction winch pump is returned to a return header and is directed through a heat exchanger and return filter back to tank.

The oil removed by hot oil shuttle valve is returned to a return header and is directed through a heat exchanger and return filter back to tank.

8.3 Storage Winch Closed Loop Circuit

8.3.1 Storage Winch - Manual Mode

Oil is drawn from the power unit reservoir through a suction strainer and into a closed loop pump. Hydraulic oil flow enters a charge pump integral to the closed loop pump. The charge pump supplies hydraulic fluid for the entire storage winch circuit at a pressure equal to approximately 340 psi. Charge pressure for storage winch closed loop pump may be read from a system pressure gauge.

8.3.1.1 Storage Winch Haul-In Circuit

Flow and pressure are directed from the charge pressure filter to a traction winch control valve. When the storage winch joystick is placed in the haul-in position, the "A" side of pump angles the swashplate, providing a flow of 28 gpm and pressure equal to 2,000 psi to the storage winch motor. The storage winch proof of tension is sensed by a pressure switch originating from the "A" gauge port on a hot oil shuttle valve. A storage winch "A" side pressure gauge and "B" side pressure gauge are attached to the A and B gauge ports, respectively, on the hot oil shuttle valve. Return flow from the hot oil shuttle valve is directed to a return header and proceeds to a heat exchanger, through a return filter and to tank.

8.3.1.2 Storage Winch Pay-Out Circuit

By placing the storage winch joystick to the pay-out position, the "B" side of pump (14) is energized which varies the swashplate angle to provide flow of 28 gpm and pressure equal to 2,000 psi to the payout side of storage winch motor.

When the storage winch joystick is moved to the haul-in or pay-out position, a solenoid valve is energized, receiving reduced pressure from a pressure reducing/relieving valve.

Case return from storage winch motor is returned directly to tank. Case return from the storage winch pump is directed to a return header and proceeds to a heat exchanger, return filter and returns to tank.

8.3.2 Automatic Mode Enable/Disable

The storage winch control joystick is placed in the haul-in position which provides flow from the "A" side of pump to the storage winch motor allowing slack in the cable between the storage winch and traction winch to be removed. Upon achieving the proper tension, the proof of tension pressure switch will close and illuminate the Proof of Tension indicator on the Local Control Enclosure. The storage winch can be placed in the Automatic Mode to provide line tension between the storage winch and traction winch equal to 2000 pounds. Upon placing the storage winch into the Automatic Mode, a levelwind servovalve is enabled and the storage winch brake is released.

Upon disabling the Automatic Mode, a directional control valve is de-energized, allowing brake pressure from brake to be returned to the levelwind return header (66), proceeding to the system return header, heat exchanger, return filter and then to tank, setting the storage winch brake. At the same time, the traction winch joystick is released to the center position which de-energizes control valve, allowing brake pressure from the motor/brake/gearbox combinations to be returned to tank, which sets the traction winch brakes. The levelwind servovalve is also disabled which deactivates the levelwind.

8.4 Levelwind Open Loop Circuit

A levelwind servovalve is energized which permits pressure and flow from a levelwind pump to pass through a high pressure filter. Pressure and flow are directed to a levelwind pressure gauge through the levelwind servovalve to a levelwind motor, which will turn in either a clockwise or counter-clockwise direction depending on the signal received by the levelwind servovalve. A pressure reducing relieving valve supplies reduced pressure to the blind end of a levelwind counter balance cylinder. A drain line is attached to the rod end of the counter balance cylinder which allows leakage to the returned to the levelwind return header and subsequently to the system return header heat exchanger, return filter and to tank.

Return flow from the levelwind servovalve proceeds to the levelwind return header, system return header, heat exchanger, return filter and to tank. The levelwind pump case returnflows directly to tank.

Section 9

Section 9 -THEORY OF ELECTRICAL OPERATIONS

The following description illustrates the Traction Winch System electrical circuit theory with a summary of relay functions and mode of operation.

9.1 Relay K1 - Not Used

9.2 Relay K2 - Not Used

9.3 Relay K3 - Traction Winch Brake Release

Relay K3, when energized, activates the following:

- Contact K3-A - (normally open), closes and activates the Traction Winch Brake Release Valve.
- Contact K3-B - (normally open), closes and enables Relay K6.

9.4 Relay K4 - Remote Enable

Relay K4, when energized, activates the following:

- Contact K4-A - (normally open), a latching contact.
- Contact K4-B - (normally open), closes and illuminates the Remote Enabled indicator located on the Traction Winch Local Control Enclosure and the Traction Winch System Remote Control Panel.

9.5 Relay K5 - Automatic Mode Enable

Relay K5, when energized, activates the following:

- Contact K5-A - (normally open), a latching contact.
- Contact K5-B - (normally open), closes and permits the Remote Enabled indicator to be activated.
- Contact K5-C - (normally open), closes and activates the Storage Winch Brake Release Relay (K6).

9.6 Relay K6 - Storage Winch Brake Release

Relay K6, when energized, activates the following:

- Contact K6-A - (normally open), closes and activates the Storage Winch Brake Solenoid.
- Contact K6-B - (normally open), closes and enables the Electro-Active Levelwind.
- Contact K6-C - (normally open), closes and energizes Relay K7.

9.7 Relay K7 - Automatic Mode Steering Relay

Relay K7 when energized by contact K6-C, activates the following:

- Contacts K7-A and K7-B - (steering contacts), are activated and switch the Storage Winch Electric Displacement Control signal from the Storage Winch joystick across a 120 ohm resistor (R3). This activates a haul-in signal which maintains back tension on the storage winch and allows the entire system to be controlled by the Traction Winch joystick.
- Contact K7-C - (normally open), an interlock that prevents the Remote Control Panel from being enabled unless the system is first placed in Automatic Mode of Operation.

9.8 Relay K8 - 12V Switching Relay

Relay K8, when energized, activates the following:

- Contacts K8-A, K8-B and K8-C - (normally open), close and switch 12V to circuits upon startup of the Diesel Power Unit.

9.9 Relay K9 - Not Used

9.10 Levelwind Circuit Theory

The Levelwind Circuitry consists of:

- PCB
- Levelwind Sensor
- Two Levelwind End of Travel (EOT) Sensors
- Levelwind Servovalve

Amplifier U1A level-shifts the input signal to zero volts at test point A. With the magnet removed and no flux signal present, zero potentiometer R4 is adjusted to indicate 0 volts at TP-A.

When an error signal is present at TP-A, the output of U1B will swing to ±12 volts. This signal is clamped to 4.0 volts and a part of this signal is added to the error signal at U1C to reduce the deadband in the hydraulic servocontrol. The amount of deadband reduction is controlled by R30. Turning R30 clockwise increases the amount of deadband. In general, the closer the levelwind carriage is to the drum, the less deadband can be tolerated. The amount of time the levelwind has to react to a fleet angle is reduced with distance and the system must respond faster by reducing deadband effects.

Overall gain is controlled by fixed resistor R14 and potentiometer R13. Turning R13 counterclockwise will increase gain of amplifier U1C. The final adjustment of R13 will depend on the characteristics of the overall system. Q1 and Q2 are current boost transistors for the output amplifier. Diodes D3 through D8 and resistors R16 and R17 form a current limiting circuit and are preset according to the servovalve coil requirements. The 405-9001-02 control board is preset to a current limit of 100 mA.

Relay K1 is energized by an external signal to enable drive signal to the servovalve. This feature prevents the levelwind from "hunting" when the winch drum is not in motion.
i.w. correct speed.
Relays K2 and K3 are energized by pushbutton switches to inject a signal to the servovalve for manual positioning. These relays override the control board signal. Potentiometers R19 and R21 determine the rate of manual movement. These can be set by the operator.

Relays K4 and K5 are energized by the end-of-travel sensors. These sensors are located so they are energized when the levelwind carriage reaches its maximum excursion. The carriage should stop when the cable is one cable diameter from the flange. This allows the cable to wrap to the flange and keeps the cable from stacking up on itself. Resistors R22 and R24 provide an opposite polarity signal when the carriage is driven to the maximum excursion. R22 and R24 provide minimal movement away from the flange when the end-of-travel sensors are encountered.
The end-of-travel sensors are proximity devices that respond to the presence of metal within the target sensor range. The end-of-travel sensors stop the levelwind carriage when the cable is approximately one cable diameter from the end of the drum flange. This prevents the cable from stacking up at the flange. If the cable is not wrapping close enough to the flange, the trigger rods that pass in front of the sensors can be moved out to allow the carriage to move closer to the drum flange. The end-of-travel sensors also prevent the carriage from manually being moved beyond the normal travel range.

The levelwind sensor is a solid state sensor that measures the fleet angle of the cable between the levelwind and the storage unit. The sensor then sends an error signal to the PCB for processing.

The levelwind servo receives the error signal from the PCB and sends it to the motor which drives the ACME screw.

If replacement of the primary ACME nut is required or the nut has no significant wear, the gap between the secondary nut and the carriage should be measured and recorded.

6.4.2 Procedure for Adjusting Levelwind Sheave Counter Balance Cylinder

WARNING

DO NOT ATTEMPT TO MAKE ANY ADJUSTMENTS TO THE LEVELWIND WITH THE STORAGE WINCH IN THE AUTOMATIC MODE.

[1] Locate the pressure reducing/relieving valve (Item PRRV-1) on the subplate assembly located behind the levelwind control enclosure on the levelwind assembly by tracing the hoses from the hydraulic cylinder to the pressure reducing/relieving valve.

[2] Utilize the proper size open end wrench to loosen the jam nut on the socket head adjustment screw while maintaining screw position with an allen wrench.

[3] With the HPU running and the storage winch in manual mode, adjust pressure upward utilizing an allen wrench to rotate the adjustment screw clockwise until the sheave assembly begins to move upward. You should be able to move the sheave up and down by applying hand pressure to the sheave assembly.

[4] After adjustment is complete, tighten the jam nut on the socket head adjustment screw while maintaining screw position with an allen wrench.

[5] Verify Adjustment: With the traction winch in the automatic mode and traction winch control handle in the neutral (center) position, observe the position of the cable in the levelwind sheave as it exits to the storage winch.

[6] If the cable is dragging on the top side cheek of the sheave assembly, readjust increasing pressure (turn adjustment screw clockwise) until the cable is centered in the sheave assembly.

[7] If the cable is dragging on the bottom side cheek of the sheave assembly, readjust decreasing pressure (turn adjustment screw counter-clockwise) until the cable is centered in the sheave assembly.

6.4.3 Procedure for Adjusting Electro-Active Levelwind

The following instructions assume that the electronic control board has been properly adjusted using the procedure printed on the electrical schematic. A simple test to check this is to unbolt the gray plastic levelwind sensor and move it away from the T-

BAR containing the magnet. The sensor is 1" x 2-1/2" x 1" thick and has a single wire coming out of one side. It is held in place by four 1/4"-20 socket head screws.

With the sensor removed and the winch running, move the control handle out of the neutral position. The levelwind should remain stationary. If it does move, this indicates that the ZERO adjustment on the circuit board is off. Refer to the electrical schematic in the manual and adjust the ZERO potentiometer for O volts at pin 1 of the integrated circuit. THE SENSOR MUST BE LOOSE AND AWAY FROM THE MAGNET DURING THIS ADJUSTMENT.

Check that the levelwind does not move when the control handle is moved from neutral and then re-install the sensor to the levelwind assembly.

The previous adjustment is done at the factory and only needs to be done if either the sensor or the control board is replaced.

The following adjustments are done when cable is first loaded on the winch. We attempt to adjust this as close as possible but until the actual end-used cable is being wrapped onto the drum, final adjustment is difficult, particularly with small cables.

There are two mechanical adjustments that may need to be made on the levelwind system. The first is the tracing adjustment which is made by loosening the pivot bolt that the sense arm assembly swings on and the bolt that is installed through an arched slot. After loosening both of there bolts, the mounting plate can be pivoted, changing the tracking position of the levelwind. The levelwind in BOTH directions of travel. At no time should the cable lead the wraps on the drum as it moves across.

The second set of adjustments are the "End-of-Travel" stops. There are two proximity sensors on the levelwind carriage that sense the passing of a metal rod sticking out to the inside of both sides of the levelwind frame. These rods are moved in/out to cause the levelwind carriage to stop when the cable is approximately one cable diameter from the edge of the drum flange. If the carriage travels too far so the cable comes up against the drum flange, the cable may stack up against the drum flange, and not roll off the start back across the drum. If the carriage stops too far away from the drum flange, gaps may appear at the flanges that will get progressively worse as cable is wound on the drum.

Section 10

Section 10 - DRAWINGS AND SCHEMATICS

10.1 DRAWINGS - GENERAL ASSEMBLY

	Drawing Number (No. Pages)
Traction Winch System Deck Arrangement	425-0000-01 (1)
Storage Winch/Levelwind General Arrangement	424-0000-01 (1)
Storage Winch General Assembly	424-1001-02 (1)
Levelwind General Assembly	424-2001-02 (1)
Levelwind Sheave Assembly	424-2003-02 (1)
Levelwind Carriage Assembly	424-2006-02 (1)
Levelwind Drive Assembly	425-2005-02 (1)
Hydraulic Power Unit General Arrangement	425-3001-01 (1)
Hydraulic Power Unit General Assembly	425-3001-02 (1)

10.2 SCHEMATICS - HYDRAULIC

Traction Winch System Hydraulic Schematic	425-8001-01 (1)
Hydraulic Schematic Component Specification	425-8009-01 (8)
Traction Winch System Flow Line Schedule	425-8009-02 (3)
Levelwind/Storage Winch Hydraulic Schematic	424-8001-01 (1)
Levelwind and Storage Winch Component Specification	424-8009-01 (4)
Leveliwnd/Storage Winch Flow Line Schedule	424-8009-02 (2)

10.3 SCHEMATICS - ELECTRICAL

Traction Winch System Electrical Schematic Diagram	425-9001-01 (1)
Traction Winch Electrical Component Specification	425-9009-01 (4)
Levelwind Electrical System Schematic Diagram	424-9001-01 (1)
Levelwind Electrical Component Specification	424-9009-01 (2)

10.4 PANEL DRAWINGS - CONTROLS AND INDICATORS

Local Control Enclosure	425-9002-01 (1)
Traction Winch System Remote Control Panel	425-9002-02 (1)
Traction Winch System Gauge Panel	405-9002-04 (1)
Hydraulic Power Unit Starter Panel	425-9002-05 (1)
Levelwind Control Panel Assembly	DYN-9002-06 (1)

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
–	A	CHANGED DP-1	10/31/95	JED
SH. 5	B	MGB-1 BRAKE WAS AUSCO 37115	12/11/95	JED

NOTES:

1. REFERENCE TAG NUMBERS TO CALLOUTS ON DRAWING No. 425-8001-01.
2. SEE DRAWING No. 425-8009-02 FOR FLOW LINE SCHEDULE.

425-8001-01	1
NEXT ASSY	QUANTITY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ±1/16 DECIMALS .XX ±.02 .XXX ±.005 ANGLES ±1/2°
REMOVE BURRS, BREAK SHARP EDGES.
MATERIAL
FINISH 125 V
APPROX. WT. LBS
DO NOT SCALE DRAWING

CUSTOMER P.O. No.
DYNACON JOB No. 425

APPROVALS		DATE
DRAWN	PRC	08/01/95
DRAFTING CHECK	DRB	08/02/95
ENGINEERING CHECK	JED	08/03/95
ENGINEERING APPROVAL	JRJ	08/04/95
PRODUCTION APPROVAL	JRJ	08/04/95

DYNACON, INC.
831 INDUSTRIAL BLVD.
BRYAN, TEXAS USA 77803

HYDRAULIC SCHEMATIC COMPONENT SPECIFICATION

SIZE	CAGE CODE	DWG NO.	REV
A	OFSDO	425-8009-01	B

SCALE 1/1 | FILE K:\425\42580901 | SHEET 1 OF 8

12/11/95 13:44

REFERENCE DIAGRAM NUMBER: 425-8001-01 APPROVED: JSD

TAG NUMBER	QTY. REQ.	COMPONENT DESCRIPTION	MANUFACTURER & PART NUMBER
BV-5	1	**BALL VALVE-** BRONZE BODY STAINLESS STEEL BALL & STEM BUNA-N SEALS CONNECTIONS: 3/4" NPT(F)	NIBCO 580-70
CC-1	1	**CLEANOUT COVER-** DIAMETER: 18" MATERIAL: STEEL	HYDROCRAFT HC-EC-18
DM-1	1	**DIESEL MOTOR** (SUPPLIED BY CUSTOMER)	DEROIT DIESEL 4-71N
DP-1	1	**DRIVE PLATE** -	CUSTOMER SUPPLIED (EXISTING)
FB-1	1	**FILLER/BREATHER** ALL STAINLESS STEEL CONSTRUCTION WITH 30 MESH STAINLESS STEEL SCREEN 3" DEEP BASKET	FLOW EZY AB-1010-3
FCV-1	1	**FLOW CONTROL VALVE** BRASS BODY, STAINLESS STEEL TRIM VITON PISTON SEAL & STEM PACKING DESIGN PRESSURE: 2000 PSI CONNECTIONS: 1/4" NPT(F) WITH INTERNAL PISTON TYPE CHECK VALVE	REGO MF250B
FL-1	1	**FILTER** - RETURN FLOW TYPE NOMINAL FLOW: 60 GPM CONNECTIONS: 1 1/2" SAE O-RING PORTS BYPASS CRACK RATING: 22 PSID WITH 10 MICRON ELEMENT ELEMENT MATERIAL: CELLULOSE FIBER WITH 0-30 PSI GAUGE	FAIREY-ARLON TTF-230--SAE24- TXX5-10-B-T-22-G TXX5-10
FL-2	1	**FILTER** - INLINE TYPE, NO BYPASS DESIGN PRESSURE: 2000 PSI WITH 7 MICRON ELEMENT ELEMENT MATERIAL: SYNTEQ® VISUAL POP-UP INDICATOR	DONALDSON HPK02K00N0807X

REFERENCE DIAGRAM NUMBER: 425-8001-01 APPROVED JSD

TAG NUMBER	QTY. REQ.	COMPONENT DESCRIPTION	MANUFACTURER & PART NUMBER
HDR-1	1	**HEADER**- RETURN TYPE CARBON STEEL SQ. TUBE BODY INLET CONNECTIONS: (1) 1" NPT (F) (1) 3/4" NPT(F), (2) 1/2" NPT(F), (2) 3/8" NPT(F) OUTLET CONNECTION: 1 1/2" NPT(F)	DYNACON 425-8003-01
HP-1	1	**HYDRAULIC PUMP** ROTATION: RIGHT HAND (CW) FSE DISPLACEMENT: 7.93 CU.IN./REV. ELECT. DISP. CONTROL W/MS CONNECTOR WITH PRESSURE LIMITER IN PORTS A&B WITH SAE-C AUXILIARY MOUNTING PAD CHARGE PUMP INLET: 1 1/4" SAE O-RING SYSTEM PORTS: 1 1/4"-6000# SPLIT FLG. WITH INTEGRAL 10 MICRON FILTER(LONG) DISPLACEMENT LIMITATION: BOTH SIDES INPUT SHAFT: 13T 8/16P SPLINE CHARGING SYSTEM: 1.60 CU.IN./REV. CONTROL ORIFICE: 0.032" DIA. HIGH PRESSURE SETTING: 6090 PSI CHARGE PRESSURE SETTING: 350 PSI	SUNSTRAND 90R130EA1C8L4F1F03 NNN424224
HP-2	1	**HYDRAULIC PUMP** ROTATION: RIGHT HAND (CW) FSE DISPLACEMENT: 3.35 CU.IN./REV. WITH PRESSURE LIMITER IN PORTS A&B WITH SAE-B AUXILIARY MOUNTING PAD CHARGE PUMP INLET: 1" SAE O-RING SYSTEM PORTS: 1"-6000# SPLIT FLANGE WITH INTEGRAL 10 MICRON FILTER(SHORT) DISPLACEMENT LIMITATION: NONE INPUT SHAFT: 14T 12/24P SPLINE CHARGING SYSTEM: 0.86 CU.IN./REV. CONTROL ORIFICE: NONE HIGH PRESSURE SETTING: 5070 PSI CHARGE PRESSURE SETTING: 350 PSI	SUNDSTRAND 90R055EA1B8P3S1C00 NNN353524

REFERENCE DIAGRAM NUMBER: 425-8001-01 APPROVED: JED

TAG NUMBER	QTY. REQ.	COMPONENT DESCRIPTION	MANUFACTURER & PART NUMBER
HP-3	1	**HYDRAULIC PUMP**- AXIAL PISTON TYPE OPEN LOOP, VARIABLE SWASHPLATE DISPLACEMENT: 28CC/REV WITH LOCAL PRESSURE CONTROL ROTAION: RIGHT HAND (CW) FSE SEAL MATERIAL: PERBUNAN INPUT SHAFT: 13T 16/32P SPLINE MOUNTING FLANGE: SAE-B (2-HOLE) SUCTION PORT: 1 1/4" SAE 4-BOLT PRESSURE PORT: 3/4" SAE 4-BOLT WITHOUT THROUGH DRIVE	MANNESMAN REXROTH A10V028DR/30R- PSC62N00
HX-1	1	**HEAT EXCHANGER**- SHELL & TUBE TYPE HEAT RATE: 99,255 BTU/HR (39 HP) SHELL: (FLUID: HYDRAULIC OIL) MATERIAL: BRASS DESIGN PRESSURE: 150 PSI CONNECTIONS: 1 1/2" NPT(F) VENTS/DRINS: 3/8" NPT(F) TUBES: (FLUID: SEA WATER) MATERIAL: 90-10 COPPER-NICKEL DESIGN PRESSURE: 150 PSI CONNECTIONS: 1" NPT(F) VENTS/DRAINS: 3/8" NPT(F)	YOUNG F502EY4PCNTB
LG-1	1	**LEVEL GAUGE**- TRANSPARENT TYPE 1/2" SIDE MOUNT PORTS GLASS TUBE, STAINLESS STEEL PORTS W/ INTEGRAL TEMP. GAUGE (0-300 DEG.F)	LUBE DEVICES G615-05-A-1
LFV-1 LFV-2	2	**LOOP FLUSHING VALVE** 3-POSITION, SPRING RETURN TO CENTER DESIGN PRESSURE: 6960 PSI (HI SIDE) 1015 PSI (LO SIDE) CHARGE PRESSURE: 350 PSI NO ORIFICE WITH INTEGRAL PRESSURE RELIEF CONNECTIONS: 3/8" SAE O-RING	SAUER SUNDSTRAND 8800485-2400

REFERENCE DIAGRAM NUMBER: 425-8001-01 APPROVED: JSR

TAG NUMBER	QTY. REQ.	COMPONENT DESCRIPTION	MANUFACTURER & PART NUMBER
MGB-1 MGB-2	2	**MOTOR/GEARBOX/BRAKE** - **HYDRAULIC MOTOR** - BIDIRECTIONAL TYPE DISPLACEMENT: 5.43 CU. IN./REV. MAXIMUM SPEED: 2900 RPM MAX. CONTINUOUS PRESSURE: 5000 PSI TORQUE: 72 lb-ft/100 PSI OUTPUT SHAFT: 14T 12/24 DP SPLINE SAE-C 4-BOLT FACE MOUNT PRESSURE CONNECTIONS: 1" SAE CODE 61 DRAIN PORT: SAE #10 WEIGHT: 99 lb **GEARBOX** - 142.3:1 RATIO MAXIMUM TORQUE: 21,033 lb-ft. MAXIMUM OUTPUT SPEED: 30 RPM WEIGHT: 568 lb. **BRAKE** - INLINE TYPE INPUT FACE: SAE-C 4-BOLT OUTPUT FACE: SAE-C 4-BOLT INPUT SPLINE: 14T 12/24 DP OUTPUT SPLINE: 14T 12/24 DP TORQUE: 8000 lb-in. (DRY) INITIAL RELEASE PRESSURE: 160 PSI FULL RELEASE PRESSSURE: 215 PSI HYDRAULIC CONNECTIONS: SAE #4 WEIGHT: 46 lb	SUNDSTRAND SERIES 23 BREVINI ET3400MN-142.3:1 MICO 3C141480-C
PA-1	1	**PUMP ADAPTER** MATERIAL: CARBON STEEL MOTOR FRAME SIZE: (TBD) PUMP FACE: SAE-D SPAN DISTANCE: (TBD)	(TO BE DETERMINED)
PG-1 PG-4	2	**PRESSURE GAUGE** STAINLESS STEEL BODY & PORT PHOSPHOR BRONZE BOURDON TUBE 2 1/2" DIAL, RANGE: 0-600 PSI REAR PANEL MOUNT PRESSURE CONNECTION: 1/4" NPT(M)	ASHCROFT 63-1008SL-02B

REFERENCE DIAGRAM NUMBER: 425-8001-01 APPROVED: JED

TAG NUMBER	QTY. REQ.	COMPONENT DESCRIPTION	MANUFACTURER & PART NUMBER
PG-2 PG-3	2	**PRESSURE GAUGE** STAINLESS STEEL BODY & PORT PHOSPHOR BRONZE BOURDON TUBE 2 1/2" DIAL, RANGE: 0-7500 PSI REAR PANEL MOUNT PRESSURE CONNECTION: 1/4" NPT(M)	ASHCROFT 63-1008SL-02B
PG-5 PG-6	2	**PRESSURE GAUGE** STAINLESS STEEL BODY & PORT PHOSPHOR BRONZE BOURDON TUBE 2 1/2" DIAL, RANGE: 0-5000 PSI REAR PANEL MOUNT PRESSURE CONNECTION: 1/4" NPT(M)	ASHCROFT 63-1008SL-02B
PG-7	1	**PRESSURE GAUGE** STAINLESS STEEL BODY & PORT PHOSPHOR BRONZE BOURDON TUBE 2 1/2" DIAL, RANGE: 0-3000 PSI REAR PANEL MOUNT PRESSURE CONNECTION: 1/4" NPT(M)	ASHCROFT 63-1008SL-02B
PG-8	1	**PRESSURE GAUGE** STAINLESS STEEL BODY & PORT PHOSPHOR BRONZE BOURDON TUBE 2 1/2" DIAL, RANGE: 0-60 PSI REAR PANEL MOUNT PRESSURE CONNECTION: 1/4" NPT(M)	ASHCROFT 63-1008SL-02B
PSH-1	1	**PRESSURE SWITCH** PRESSURE RANGE: 235-3400 PSI SINGLE POLE DOUBLE THROW CONTACT PRESSURE CONNECTION: 1/4" NPT(F) ELECTRICAL CONNECTION: 1/2" NPT(F) VOLTAGE: 24 VAC	BARKSDALE 9675-3
QD-1	1	**QUICK DISCONNECT** COUPLING (FEMALE) CONNECTION SIZE: 1/2" NPT(F)	STAUBLI RBE08-2203/OD/IA/ 3/HP/FB/DKR
QD-3	1	**QUICK DISCONNECT** COUPLING (FEMALE) CONNECTION SIZE: 1/2" NPT(F)	STAUBLI RBE08-7203/IA/3/HP
QD-7	1	QUICK DISCONNECT COUPLING (FEMALE) CONNECTION SIZE: 1/2" NPT(F) WITH PLASTIC PLUG	HANSEN LL4-H26 w/PPDC-4HK

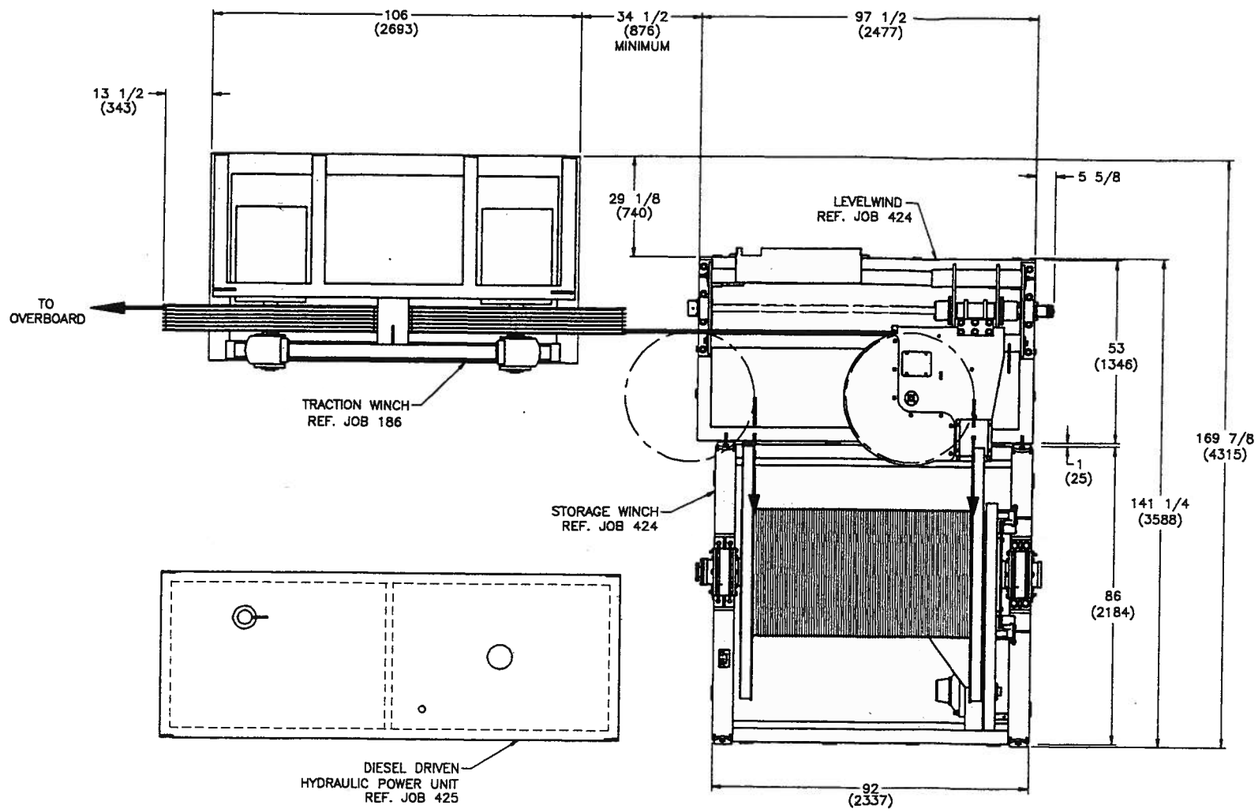
REFERENCE DIAGRAM NUMBER: 425-8001-01 APPROVED: JSR

TAG NUMBER	QTY. REQ.	COMPONENT DESCRIPTION	MANUFACTURER & PART NUMBER
QD-9	1	**QUICK DISCONNECT** COUPLING (FEMALE) CONNECTION SIZE: 3/4" NPT(F)	STAUBLI RBE11-2204/OD/IA/ 6/HP/FB/DKB
QD-11	1	**QUICK DISCONNECT** COUPLING (FEMALE) CONNECTION SIZE: 3/4" NPT(F)	STAUBLI RBE11-2204/OD/IA/ 1.5/HP/FB/DKW
QD-13	1	**QUICK DISCONNECT** COUPLING (FEMALE) CONNECTION SIZE: " NPT(F)	STAUBLI RBE19-2205/OD/IA/ 3/HP/FB/DKR
QD-14	1	**QUICK DISCONNECT** COUPLING (MALE) CONNECTION SIZE: 1" NPT(F)	STAUBLI RBE19-7205/OD/IA/ 3/HP
QD-15	1	**QUICK DISCONNECT** COUPLING (FEMALE) CONNECTION SIZE: 1" NPT(F)	STAUBLI RBE19-2205/OD/IA/ 4.5/HP/FB/DKR
QD-16	1	**QUICK DISCONNECT** COUPLING (MALE) CONNECTION SIZE: 1" NPT(F)	STAUBLI RBE19-7205/OD/IA/ 4.5/HP
QD-17	1	**QUICK DISCONNECT** COUPLING (FEMALE) CONNECTION SIZE: 1/4" NPT(F)	STAUBLI RBE06-2201/OD/IA/ 1.5/HP/FB/DKW
QD-18	1	**QUICK DISCONNECT** COUPLING (MALE) CONNECTION SIZE: 1/4" NPT(F)	STAUBLI RBE06-7201/OD/IA/ 1.5/HP
QD-19	1	**QUICK DISCONNECT** COUPLING (FEMALE) CONNECTION SIZE: 3/4" NPT(F) WITH PLASTIC PLUG	HANSEN LL6-H31 w/PPDC-6HK
QD-20	1	**QUICK DISCONNECT** COUPLING (MALE) CONNECTION SIZE: 3/4" NPT(F) WITH PLASTIC CAP	HANSEN LL6-K31 w/PSDC-6HK

REFERENCE DIAGRAM NUMBER: 425-8001-01 APPROVED:

TAG NUMBER	QTY. REQ.	COMPONENT DESCRIPTION	MANUFACTURER & PART NUMBER
SOV-1	2	**SOLENOID OPERATED VALVE** DIRECT ACTING, SPRING RETURN FLOW: 10 GPM NOMINAL DESIGN PRESSURE: 3000 PSI MAX. INTERNAL LEAKAGE: 5 CU.IN./MIN. RESPONSE TIME: 30-45 ms BUNA-N O-RING SEALS PRESSURE CONNECTIONS: 3/8" SAE O-RING 12 WATT STANDARD COIL WITH HIRSCHMANN ELECTRICAL CONNECTOR FAIL POSITION: NORMALLY OPEN SOLENOID VOLTAGE: 12 VDC WEIGHT: 4.4 oz.	DELTA DFS3A00HC12S
STR-1 STR-2	2	**STRAINER**- SUMP TYPE FLOW RATE: 50 GPM MAX. 200 MESH STAINLESS STEEL SCREEN CONNECTION: 1 1/2" NPT(F)	FLOW EZY 50-1 1/2-200
STR-3	1	**STRAINER**- SUMP TYPE FLOW RATE: 50 GPM MAX. 100 MESH STAINLESS STEEL SCREEN CONNECTION: 1 1/2" NPT(F)	FLOW EZY 50-1 1/2-100=

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	PER DCN DATED 11/03/95	11/10/95	



TRACTION WINCH SPECIFICATIONS	
LINE SPEED	138 ft/min
LINE TENSION	18,000 lb
BRAKING/STATIC TENSION	25,000 lb
WEIGHT	10,500 lb

LEVELWIND SPECIFICATIONS	
LINE TENSION	2300 lb
WEIGHT	2200 lb
LONGITUDINAL TRAVEL	64 in
ANGULAR TRAVEL	36°–50°
SHEAVE ROOT DIAMETER	36.92 in

CABLE DATA	
CABLE DIAMETER	0.68 in
CABLE WEIGHT	17,300 lb

POWER UNIT SPECIFICATIONS	
HYDRAULIC OIL CAPACITY	135 gal.
FUEL CAPACITY	50 gal.
DRIVER POWER	155 HP
DRIVER SPEED	2100 RPM
TRACTION WINCH PUMP PRESSURE	4200 PSI
STORAGE WINCH PUMP PRESSURE	2300 PSI
LEVELWIND PUMP PRESSURE	2000 PSI

STORAGE WINCH SPECIFICATIONS	
LINE TENSION	2300 lb
WEIGHT (EMPTY)	8200 lb
WRAPS/LAYER	90
No. OF LAYERS	30

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± 1/8, DECIMALS .XX ± .01, .XXX ± .005, ANGLES ± 1/2°. REMOVE BURRS, BREAK SHARP EDGES. MATERIAL. FINISH 125 √. APPROX. WEIGHT, LBS. DO NOT SCALE DRAWING.

CUSTOMER P.O. No.	DYNACON JOB No. 425	
APPROVALS		DATE
DRAWN	ALN	09/05/95
DRAFTING CHECK	DRB	09/11/95
ENGINEERING CHECK	JRJ	09/11/95
ENGINEERING APPROVAL	JRJ	09/11/95
PRODUCTION APPROVAL	DJ	09/11/95

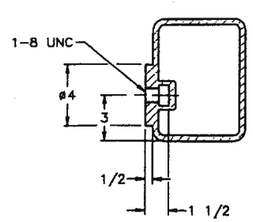
TRACTION WINCH SYSTEM DECK ARRANGEMENT

SIZE	CAGE CODE	DWG NO.	REV
D	OFSDO	425-0000-01	A

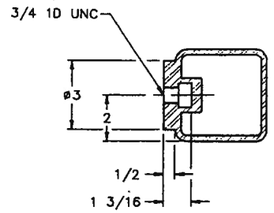
SCALE 1/20 | PATH: J:\425\42500001 | SHEET 1 OF 1 | 11/13/95 16:30

NOTE:
FOR DECK ARRANGEMENT INCLUDING TRACTION WINCH,
SEE DYNACON DRAWING No. 425-0000-01.

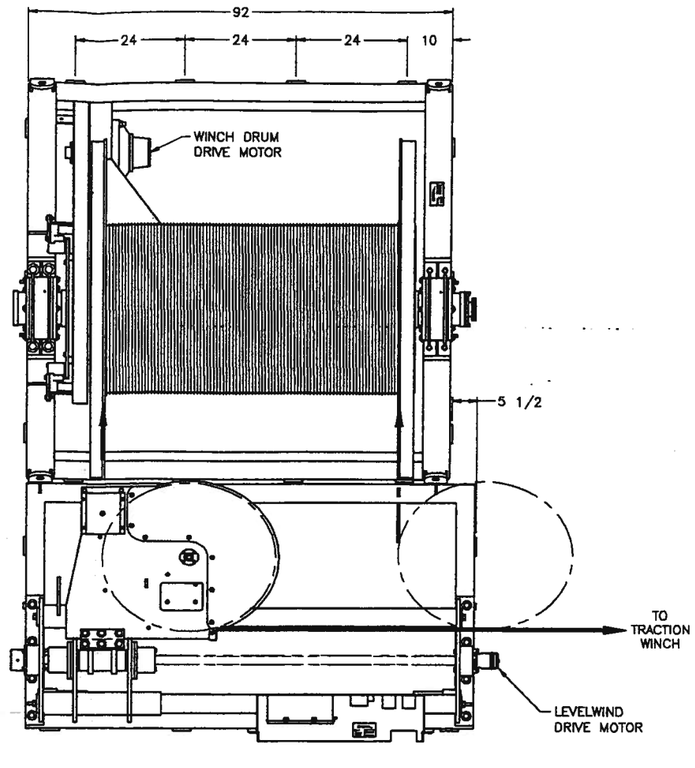
REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	PER DCN DATED 11/09/95	11/03/95	

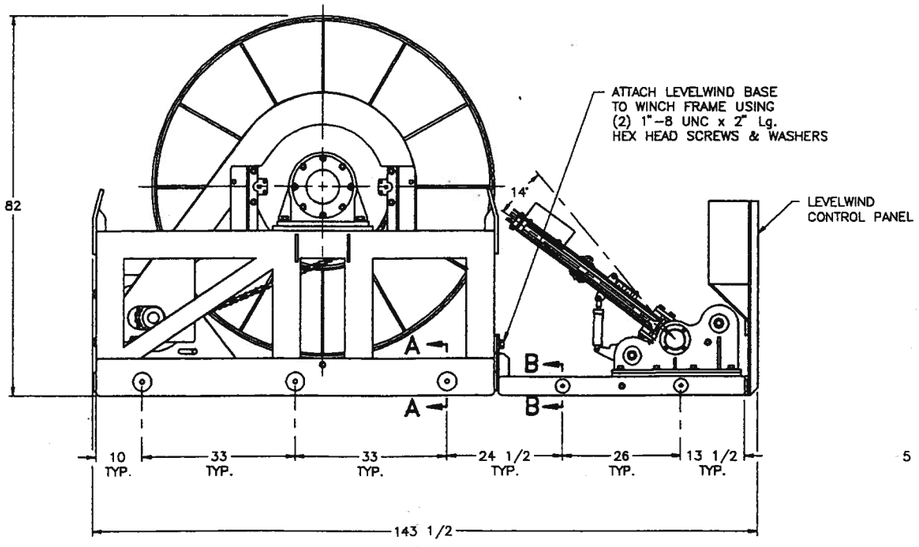


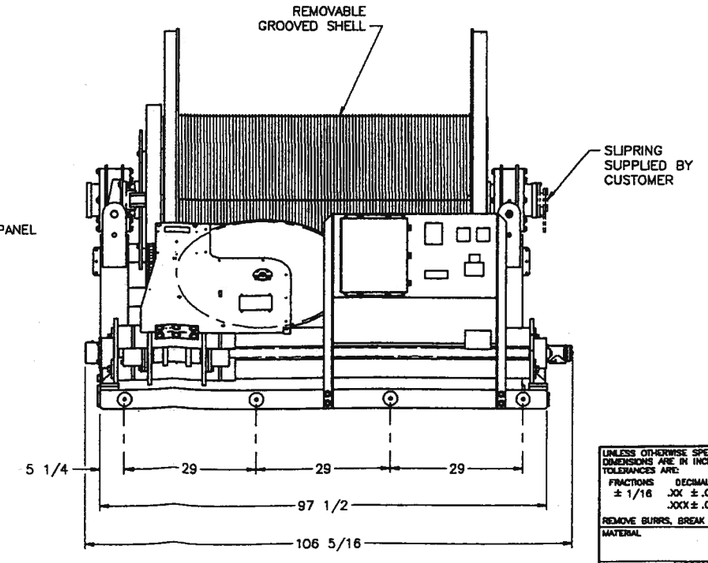
SECTION A-A
SCALE: NONE
TYP. 14 PLACES
(1D TO BE USED)



SECTION B-B
SCALE: NONE
TYP. 8 PLACES

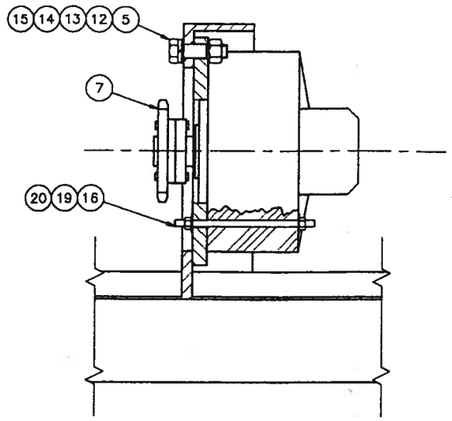




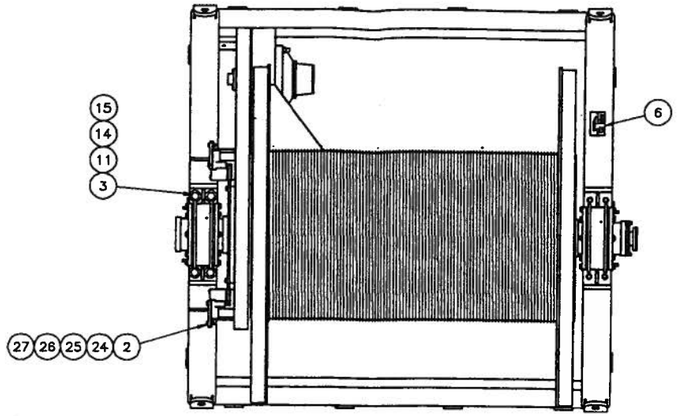


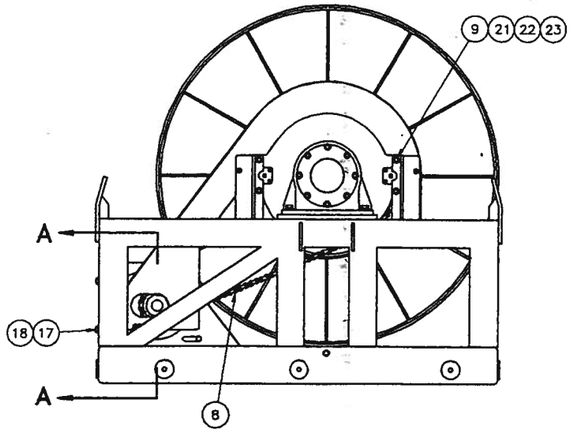
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± 1/16, DECIMALS .XX ± .02, .XXX ± .005, ANGLES ± 1/2°	CUSTOMER P.O. No.	DYNACON JOB No. 424	THIS DRAWING IS THE PROPERTY OF DYNACON, INC. 831 INDUSTRIAL BLVD. BRYAN, TEXAS USA 77803 — ANY REPRODUCTION OR USE OF THIS DESIGN IS EXPRESSLY FORBIDDEN UNLESS AUTHORIZED IN WRITING.
REMOVE BURRS, BREAK SHARP EDGES.	APPROVALS	DATE	STORAGE WINCH / LEVELWIND GENERAL ARRANGEMENT
MATERIAL	DRAWN ALN	09/15/95	
FINISH 125 √ — APPROX. WEIGHT, LBS: SEE TABLES	DRAFTING CHECK DRB	09/18/95	
DO NOT SCALE DRAWING	ENGINEERING CHECK JRJ	09/22/95	SIZE D — CAGE CODE OFSDO — DWG NO. 424-0000-01 — REV A
	ENGINEERING APPROVAL JRJ	09/22/95	SCALE 1/15 — PATH J:\424\42400001 — SHEET 1 OF 1
	PRODUCTION APPROVAL DJ	09/21/95	11/10/95 08:02

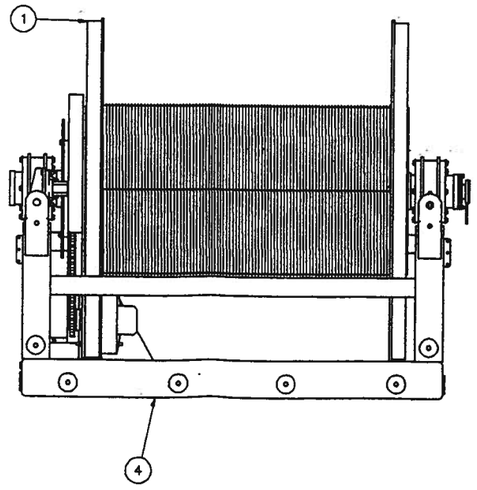
REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	PER DCN DATED 11/03/95	11/10/95	



SECTION A–A
SCALE: 1/5







IDENTIFICATION TAG DATA	
MODEL NUMBER	N/A
SERIAL NUMBER	425101W
DATE OF MANUFACTURE	10/95
EMPTY WEIGHT	8200
MAX. GROSS WEIGHT	31,200
CERTIFICATION	N/A

QTY REQD	PART NUMBER	DESCRIPTION	MATERIAL SPECIFICATION	ITEM NO.
3		LOCK WASHER ø3/8 HELICAL SPRING	18–8 STAINLESS STEEL	27
6		FLAT WASHER ø3/8	18–8 STAINLESS STEEL	26
3		HEX NUT 3/8–16 UNC	18–8 STAINLESS STEEL	25
3		HEX HEAD SCREW 3/8–16 UNC x 1 1/2 Lg.	18–8 STAINLESS STEEL	24
4		HEX NUT, SELF LOCKING 1/2–13 UNC	18–8 STAINLESS STEEL	23
8		FLAT WASHER ø1/2	18–8 STAINLESS STEEL	22
4		HEX HEAD SCREW 1/2–13 X 2 1/2 Lg.	18–8 STAINLESS STEEL	21
10		FLAT WASHER ø3/4	18–8 STAINLESS STEEL	20
10		HEX NUT, SELF LOCKING 3/4–10 UNC	18–8 STAINLESS STEEL	19
2		HEX NUT 3/4–10 UNC	18–8 STAINLESS STEEL	18
2		HEX HEAD SCREW 3/4–10 UNC x 4 1/2 Lg.	18–8 STAINLESS STEEL	17
5		THREADED ROD 1/2–10 UNC x 10 Lg.	18–8 STAINLESS STEEL	16
11		LOCK WASHER ø1 HELICAL SPRING	18–8 STAINLESS STEEL	15
14		FLAT WASHER ø1	18–8 STAINLESS STEEL	14
3		HEX NUT 1–8 UNC	18–8 STAINLESS STEEL	13
3		HEX HEAD SCREW 1–8 UNC x 3 Lg.	18–8 STAINLESS STEEL	12
8		HEX HEAD SCREW 1–8 UNC x 3 3/4 Lg.	ZINC COATED Gr. 5 STEEL	11
1	MR450	HYDRAULIC MOTOR (SEE 424–8009–01, TAG HM–1)	CALZONE	10
2	03–530–126	CALIPER BRAKE (SEE 424–8009–01, TAG BK–1, BK–2)	MICO	9
1	NO. 100	ROLLER CHAIN 128 PITCHES		8
1	100SF17	SPROCKET, "QD" STYLE W/BUSHING 60mm, KEY 16 x 10 x 70	MARTIN	7
1	DYN–9002–99	IDENTIFICATION TAG ENGRAVE PER DATA THIS SHEET		6
1	424–1007–14	MOTOR MOUNT PLATE		5
1	414–1007–01	WINCH FRAME		4
1	414–1005–01	BEARING ASSEMBLY		3
1	414–1004–05	CHAIN GUARD		2
1	414–1003–01	WINCH DRUM ASSEMBLY		1

PARTS LIST

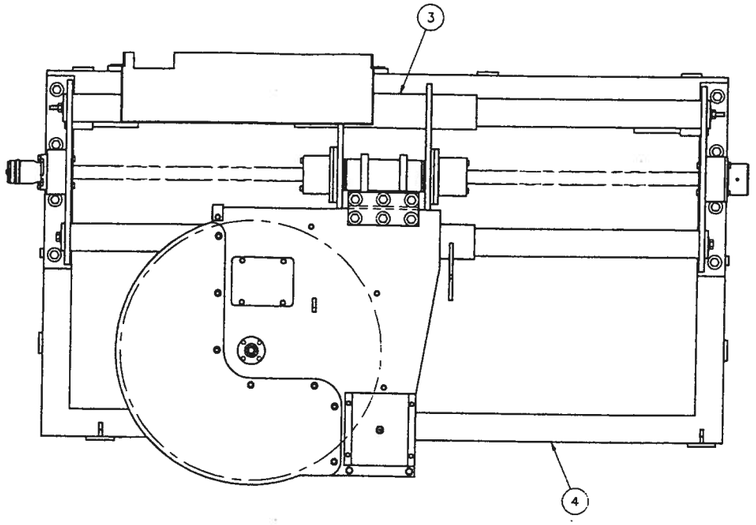
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± 1/16, DECIMALS .XX ± .02 .XXX ± .005, ANGLES ± 1/2°
REMOVE BURRS, BREAK SHARP EDGES.
MATERIAL: SEE PARTS LIST
FINISH 125 √
APPROX. WEIGHT, LBS: 10,254
DO NOT SCALE DRAWING

CUSTOMER P.O. No.	DYNACON JOB No. 424
APPROVALS	DATE
DRAWN ALN	07/17/95
DRAFTING CHECK DRB	07/17/95
ENGINEERING CHECK JRJ	07/17/95
ENGINEERING APPROVAL JRJ	07/17/95
PRODUCTION APPROVAL DJ	07/17/95

STORAGE WINCH GENERAL ASSEMBLY

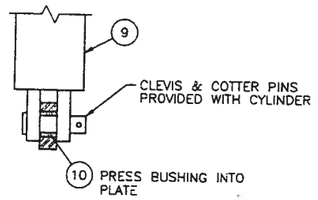
SIZE	CAGE CODE	DWG NO.	REV
D	OFSDO	424–1001–02	A
SCALE 1/15	PATH J:\424\42410102	SHEET 1 OF 1	

11/10/95 08:34

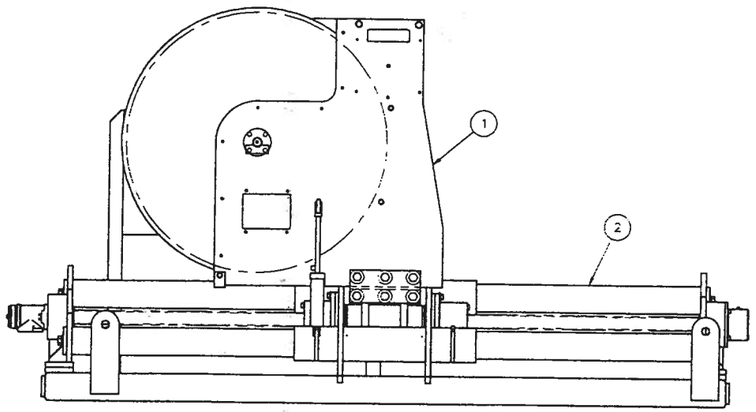


(SHEAVE SHOWN IN HORIZONTAL POSITION)

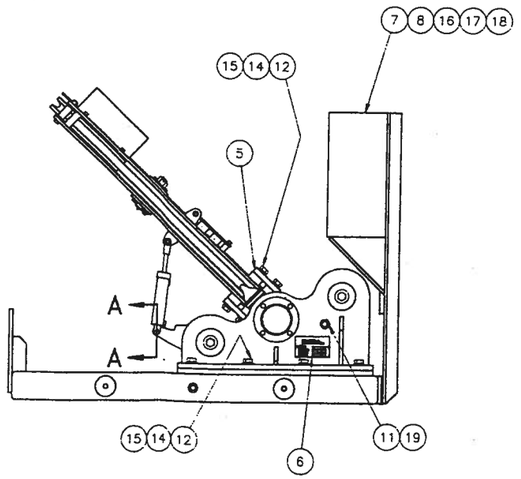
IDENTIFICATION TAG DATA	
MODEL NUMBER	N/A
SERIAL NUMBER	424103EALW
DATE OF MANUFACTURE	
EMPTY WEIGHT	N/A
GROSS WEIGHT	2300 lb
CERTIFICATION	N/A



SECTION A–A
SCALE: 1/2
TYP. EACH END OF CYLINDER



(SHEAVE SHOWN IN VERTICAL POSITION)



QTY REQD	PART NUMBER	DESCRIPTION	MATERIAL SPECIFICATION	ITEM NO.
4	-	SOCKET HEAD SET SCREW, CUP POINT 1/4–20 UNC x 1/4 Lg.	18–8 STAINLESS STEEL	19
4		LOCK WASHER ø1/2 HELICAL SPRING	18–8 STAINLESS STEEL	18
4		FLAT WASHER ø1/2	18–8 STAINLESS STEEL	17
4		HEX HEAD SCREW 1/2–13 UNC x 3/4 Lg.	18–8 STAINLESS STEEL	16
20		LOCK WASHER ø3/4 HELICAL SPRING	18–8 STAINLESS STEEL	15
20		FLAT WASHER ø3/4 SAE	18–8 STAINLESS STEEL	14
20		HEX HEAD SCREW 3/4–10 UNC x 2 Lg.	ZINC COATED Gr. 5 CARBON STEEL	12
2		ROUND ROD ø3/4 x 10 1/2 Lg.	AISI TYPE 304L STAINLESS STEEL	11
2	405–2006–35	CYLINDER BUSHING	SYMMCO	10
1	BMC 1508	HYDRAULIC CYLINDER (SEE DWG. #424–8001–01; TAG CY–1)	CENTRAL	9
1	405–8003–01	RETURN HEADER		8
1	405–2004–01	VALVE PANEL		7
1	DYN–9002–99	IDENTIFICATION TAG ENGRAVE PER DATA THIS SHEET		6
2	414–2003–15	MOUNT PLATE		5
1	424–2007–02	FRAME		4
1	424–2006–02	CARRIAGE ASSEMBLY		3
1	424–2005–02	DRIVE ASSEMBLY		2
1	424–2003–02	SHEAVE ASSEMBLY		1

PARTS LIST

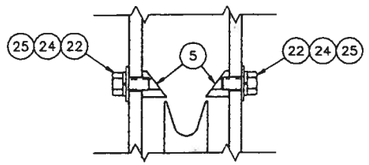
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± 1/16, DECIMALS .XX ± .02, .XXX ± .005, ANGLES ± 1/2°
REMOVE BURRS, BREAK SHARP EDGES
MATERIAL: SEE PARTS LIST
FINISH: 125
APPROX. WEIGHT: 2300 LBS
DO NOT SCALE DRAWING

CUSTOMER P.O. No. | DYNACON JOB No. 424

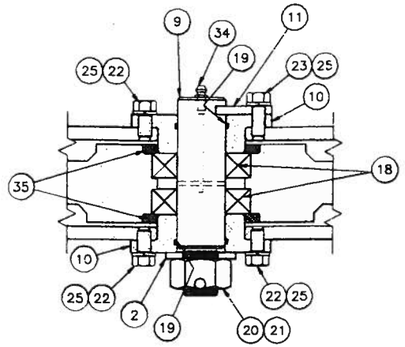
APPROVALS	DATE
DRAWN ALN	07/17/95
DRAFTING CHECK DRB	7/25/95
ENGINEERING CHECK 1.	7/25/95
ENGINEERING APPROVAL 2.	7/25/95
PRODUCTION APPROVAL	7/25/95

LEVELWIND GENERAL ASSEMBLY

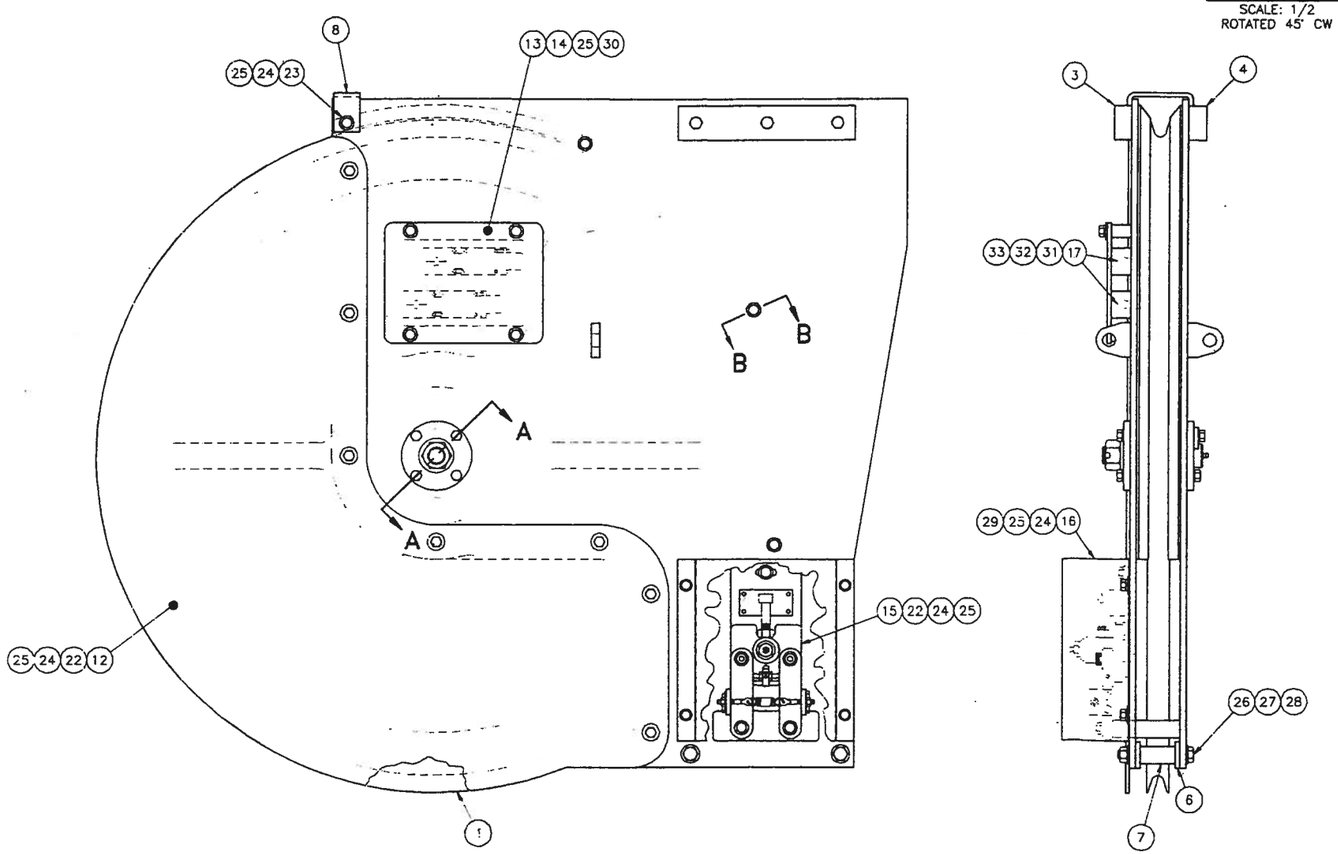
SIZE D | CAGE CODE OFSDO | DWG NO. 424–2001–02 | REV –
SCALE 1/10 | PATH J:\424\42420102 | SHEET 1 OF 1
07/24/95 | 16:41



SECTION B–B
SCALE: 1/2
TYP. 3 PLACES



SECTION A–A
SCALE: 1/2
ROTATED 45° CW



QTY REQD	PART NUMBER	DESCRIPTION	MATERIAL SPECIFICATION	ITEM NO.
4		LOCK WASHER #10 HELICAL SPRING	18–8 STAINLESS STEEL	32
4		SLOTTED PAN HEAD SCREW 10–32 UNF x 1 3/4 LG	18–8 STAINLESS STEEL	31
4		HEX HEAD SCREW 3/8–16 UNC x 1 3/4 LG	18–8 STAINLESS STEEL	30
4		HEX HEAD SCREW 3/8–16 UNC x 5/8 LG	18–8 STAINLESS STEEL	29
4		FLAT WASHER ø1/2	18–8 STAINLESS STEEL	28
2		SELF LOCKING HEX NUT ø1/2	18–8 STAINLESS STEEL	27
4		HEX HEAD SCREW 1/2–13 UNC x 4 Lg.	18–8 STAINLESS STEEL	26
32		LOCK WASHER ø3/8 HELICAL SPRING	18–8 STAINLESS STEEL	25
20		FLAT WASHER ø3/8	18–8 STAINLESS STEEL	24
4		HEX HEAD SCREW 3/8–16 UNC x 1 LG	18–8 STAINLESS STEEL	23
20		HEX HEAD SCREW 3/8–16 UNC x 3/4 LG	18–8 STAINLESS STEEL	22
1		COTTER PIN ø3/16 x 3" Lg.	18–8 STAINLESS STEEL	21
1		SLOTTED HEX NUT 1–14 NS	ZINC COATED GR. 5 STEEL	20
2	2–126	O–RING	BUNA–N	19
2	30207	RDLLER BEARING	SKF	18
2	IME 2020	IME SENSOR	EFECTOR	17
1	DYN–2008–51	SENSOR COVER		16
1	DYN–2008–02	LEVELWIND SENSOR		15
4	157J–2002–07	LINE COUNT SPACER		14
1	DYN–2002–06	LINE COUNT PLATE		13
1	DYN–2003–53	SHEAVE GUARD		12
1	DYN–2003–10	RETAINER BAR		11
2	DYN–2003–09	BEARING RETAINER		10
1	DYN–2003–08	BEARING PIN		9
1	414–2003–21	CHEEK PLATE (U) SPACER		8
2	414–2003–20	CHEEK PLATE SPACER		7
2	DYN–2003–19	BRUSH GUARD		6
2	DYN–2003–18	FAIRING		5
1	414–2003–13	BOTTOM CHEEK PLATE WELDMENT		4
1	414–2003–12	TOP CHEEK PLATE WELDMENT		3
1	DYN–2003–11	WASHER		2
1	424–2003–04	LEVELWIND SHEAVE		1

PARTS LIST

QTY REQD	PART NUMBER	DESCRIPTION	MATERIAL SPECIFICATION	ITEM NO.
2	10345 LPD	SEAL	J–W	35
1		GREASE ZERK 1/4–28 UNF	18–8 STAINLESS STEEL	34
4		FLAT WASHER #10	18–8 STAINLESS STEEL	33

PARTS LIST

424–2001–02	1
NEXT ASSEMBLY	QUANTITY
APPLICATION	

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ARE:
FRACTIONS ± 1/16 DECIMALS .XX ± .02 .XXX ± .005 ANGLES ± 1/2°
REMOVE BURRS, BREAK SHARP EDGES.
MATERIAL: SEE PARTS LIST
FINISH 125 APPROX. WEIGHT, LBS 500
DO NOT SCALE DRAWING

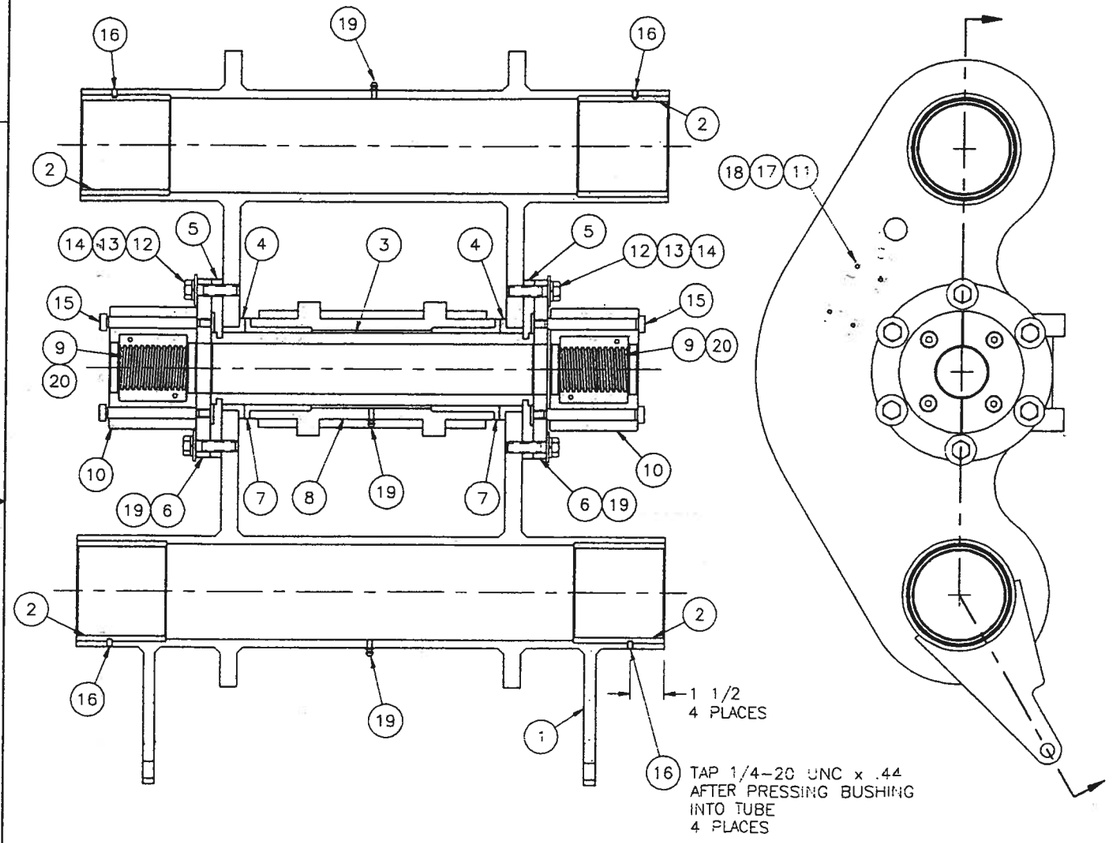
CUSTOMER P.O. No. | DYNACON JOB No. 424

APPROVALS	DATE
DRAWN ALN	07/17/95
DRAFTING CHECK DRB	7/21/95
ENGINEERING CHECK	7/25/95
ENGINEERING APPROVAL	7/25/95
PRODUCTION APPROVAL	7/24/95

LEVELWIND SHEAVE ASSEMBLY

SIZE B | CAGE CODE OFSDO | DWG NO. 424–2003–02 | REV –
SCALE 1/4 | PATH J:\424\42420302 | SHEET 1 OF 1
07/21/95 14:33

REPLACES 414-2003-02



QTY REQD	PART NUMBER	DESCRIPTION	MATERIAL SPECIFICATION	ITEM NO.
2		KEY 3/8 SQ. x 2.13	AISI TYPE 304 STAINLESS STEEL	20
5		GREASE ZERK 1/4-28 UNF	STAINLESS STEEL	19
8		LOCK WASHER #10 HELICAL SPRING	18-8 STAINLESS STEEL	18
8		HEX SOCKET HEAD SCREW 10-32 UNF x 2	18-8 STAINLESS STEEL	17
4		SET SCREW, CUP POINT 1/4-20 UNC x 3/8	18-8 STAINLESS STEEL	16
8		HEX SOCKET HEAD SHOULDER SCREW 1/2 x 4 LG (3/8-16 UNC THREADS)	18-8 STAINLESS STEEL	15
12		FLAT WASHER ø1/2	18-8 STAINLESS STEEL	14
12		LOCK WASHER ø1/2 HELICAL SPRING	18-8 STAINLESS STEEL	13
12		HEX HEAD SCREW 1/2-13 UNC x 2	18-8 STAINLESS STEEL	12
2	IME 2D20	PROXIMITY SENSOR	EFFECTOR	11
2	DYN-2004-06	2" ACME NUT HOUSING		10
2	DYN-2004-05	2-4 RH ACME NUT		9
1	414-2006-30	TILT BRACKET		8
2	DYN-2006-15	TILT TUBE INNER BUSHING		7
2	DYN-2006-14	ACME NUT MOUNT PLATE		6
2	DYN-2006-13	TILT PIN RETAINER		5
2	DYN-2006-12	TILT TUBE OUTER BUSHING		4
1	DYN-2006-11	TILT PIN		3
4	DYN-2006-06	GUIDE TUBE BUSHING		2
1	DYN-2006-04	SLIDE FRAME		1

PARTS LIST

414-2001-02	1
NEXT ASSEMBLY	QUANTITY
APPLICATION	

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ±1/16 DECIMALS .XX ±.02 .XXX±.005 ANGLES ±1/2°
REMOVE BURRS, BREAK SHARP EDGES.
MATERIAL: SEE PARTS LIST
FINISH 125 V
APPROX. WEIGHT, LBS 330
DO NOT SCALE DRAWING

CUSTOMER P.O. No.	DYNACON JOB No.	424
APPROVALS		DATE
DRAWN	ALN	07/17/95
DRAFTING CHECK	DRB	7/18/95
ENGINEERING CHECK		7/19/95
ENGINEERING APPROVAL		7/19/95
PRODUCTION APPROVAL		7/19/95

THIS DRAWING IS THE PROPERTY OF DYNACON, INC. 831 INDUSTRIAL BLVD. BRYAN, TEXAS USA 77803

LEVELWIND CARRIAGE ASSEMBLY

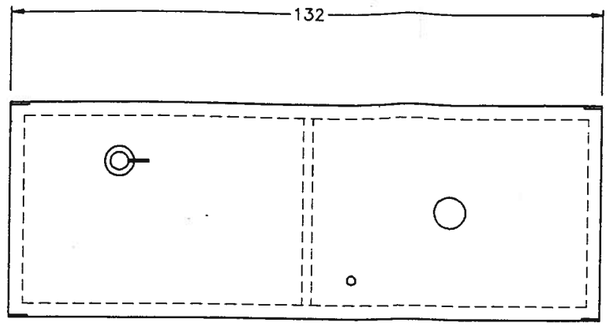
SIZE	CAGE CODE	DWG NO.	REV
C	OFSDO	424-2006-02	—

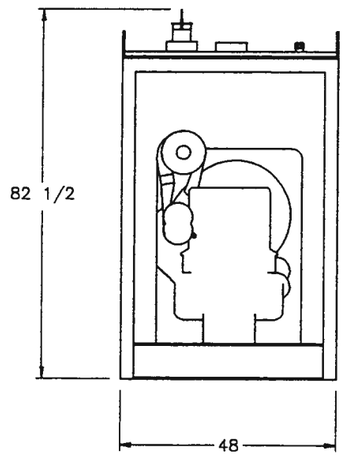
SCALE 1/4 FILE J:\424\42420602 SHEET 1 OF 1

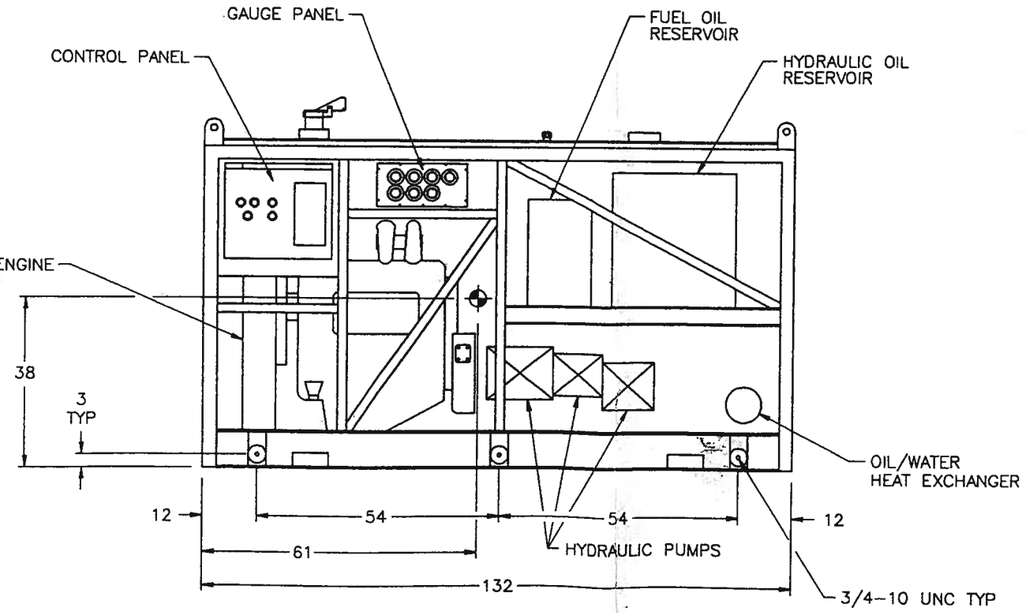
07/18/95 08:06

REPLACES 414-2006-02

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	PER DCN DATED 11/03/95	~~11~~/10/95	





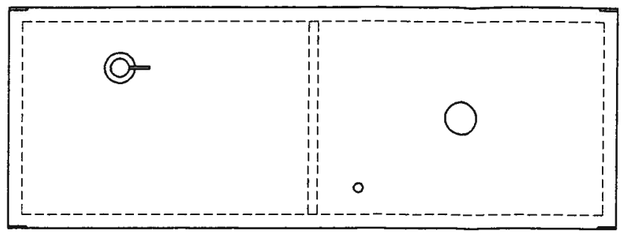


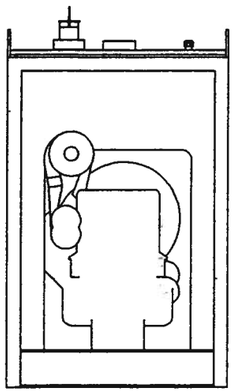
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ±1/16 DECIMALS .XX ±.02 .XXX ±.005 ANGLES ±1/2° REMOVE BURRS, BREAK SHARP EDGES.	CUSTOMER P.O. No.	DYNACON JOB No. 425	THIS DRAWING IS THE PROPERTY OF DYNACON, INC. 831 INDUSTRIAL BLVD. BRYAN, TEXAS USA 77803
MATERIAL	APPROVALS	DATE	ANY REPRODUCTION OR USE OF THIS DESIGN IS EXPRESSLY FORBIDDEN UNLESS AUTHORIZED IN WRITING.
FINISH 125 V APPROX. WEIGHT, LBS 7900	DRAWN PRC	08/02/95	HYDRAULIC POWER UNIT GENERAL ARRANGEMENT
DO NOT SCALE DRAWING	DRAFTING CHECK DRB	08/08/95	
	ENGINEERING CHECK JRJ	08/09/95	SIZE C CAGE CODE OFSDO DWG NO. 425-3001-01 REV A
	ENGINEERING APPROVAL JRJ	08/09/95	
	PRODUCTION APPROVAL DJ	08/08/95	SCALE 1/20 FILE J:\425\42530101 SHEET 1 OF 1

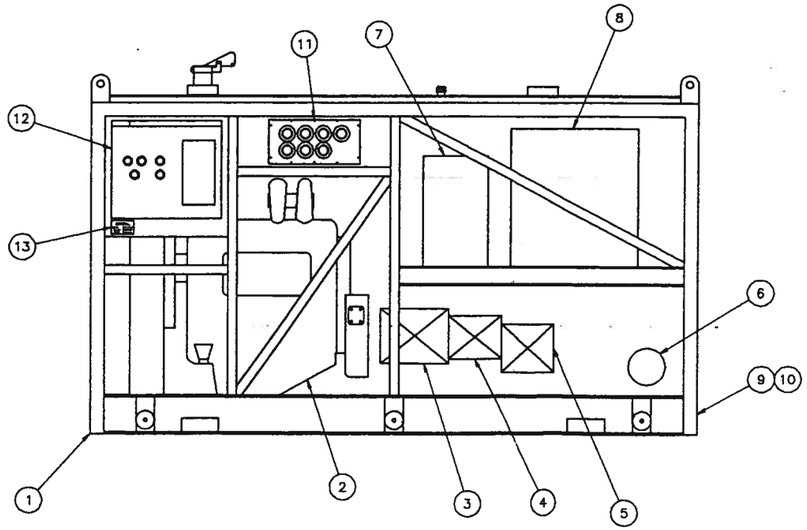
11/10/95 08:40

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	PER DCN DATED 11/03/95	11/10/95	

IDENTIFICATION TAG DATA	
MODEL NUMBER	N/A
SERIAL NUMBER	425102DHPU
DATE OF MANUFACTURE	10/95
EMPTY WEIGHT	5450 lb
GROSS WEIGHT	7300 lb
CERTIFICATION	N/A







QTY REQD	PART NUMBER	DESCRIPTION	MATERIAL SPECIFICATION	ITEM NO.
1	DYN-9002-99	IDENTIFICATION TAG (ENGRAVE PER DATA THIS SHEET)		13
1	405-9002-05	STARTER PANEL		12
1	405-9002-04	GAUGE PANEL		11
1	405-3008-02	RETURN BULKHEAD LABEL		10
1	405-3008-01	PRESSURE BULKHEAD LABEL		9
1	265-3003-02	HYDRAULIC OIL TANK		8
1	265-3003-01	FUEL TANK		7
1	F502EY4PCNTB	HEAT EXCHANGER (SEE 425-8009-01 TAG No. HX-1)	YOUNG	6
1	A10V028DR/30R	LEVELWIND PUMP (SEE 425-8009-01 TAG No. HP-3)	MANESMAN/REXROTH	5
1	90R055EA1B8P	STORAGE WINCH PUMP (SEE 425-8009-01 TAG No. HP-2)	SUNDSTRAND	4
1	9DR130EA1C8L	TRACTION WINCH PUMP (SEE 425-8009-01 TAG No. HP-1)	SUNSTRAND	3
1	4-71N	DIESEL ENGINE (SEE 425-8009-01 TAG No. DM-1)	DETROIT	2
1	265-3001-02	POWER UNIT FRAME		1

PARTS LIST

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ARE:
FRACTIONS ± 1/16 DECIMALS .XX ± .02 .XXX ± .005 ANGLES ± 1/2
REMOVE BURRS, BREAK SHARP EDGES.
MATERIAL SEE PARTS LIST
FINISH 125 APPROX. WEIGHT, LBS 7900
DO NOT SCALE DRAWING

CUSTOMER P.O. No. | DYNACON JOB No. 425

APPROVALS		DATE
DRAWN	PRC	08/02/95
DRAFTING CHECK	DRB	08/07/95
ENGINEERING CHECK	JRJ	08/08/95
ENGINEERING APPROVAL	JRJ	08/08/95
PRODUCTION APPROVAL	DJ	08/07/95

DYNACON, INC.
831 INDUSTRIAL BLVD.
BRYAN, TEXAS USA 77803

HYDRAULIC POWER UNIT GENERAL ASSEMBLY

SIZE D | CAGE CODE OFSDO | DWG NO. 425-3001-02 | REV A
SCALE 1/15 | PATH J:\425\42530102 | SHEET 1 OF 1
11/10/95 09:12

HYDRAULIC COMPONENT

REFERENCE DWG # 425-8001-01/8009-01

ITEM # HP-1, HP-2

MANUFACTURER: SUNDSTRAND, 2800 E. 13th St. AMES, IOWA 50010 515-239-6000

DESCRIPTION: HYDRAULIC PUMP

PART NUMBER: 90R130EA1C8L4F1F03NNN424
90R055EA1B8P3S1C00NNN353

Technical Data - Variable Displacement Pump

Frame Size		030	042	055	075	100	130	180	250
Product Status									
Available			X	X	X	X	X		
In Development*		X						X	X
Displacement (Maximum)									
in³/Rev		1.83	2.56	3.35	4.57	6.10	7.93	10.98	15.25
cc/Rev		30	42	55	75	100	130	180	250
Input Speed									
Maximum - RPM		5000	5000	4700	4300	4000	3700	3500	3100
Continuous - RPM		4200	4200	3900	3600	3300	3100	2900	2600
Minimum - RPM		500	500	500	500	500	500	500	500
Pressure									
Maximum	PSI	7000							
	BAR	480							
Continuous	PSI	6000							
	BAR	420							
Case Pressure									
Continuous	PSI	40							
	BAR	3							
Maximum	PSI	75							
(Cold Start)	BAR	5							
Input Mounting Flange (per SAE J744)		SAE B	SAE B	SAE C	SAE C	SAE C	SAE D	SAE D	SAE D
Input Shaft (Std. Spline)									
Number of Teeth and Pitch		15T 16/32P	15T 16/32P	14T 12/24P	14T 12/24P	13T 8/16P	13T 8/16P	13T 8/16P	13T 8/16P
Weight									
	lbs	62	75	88	108	150	195	260	300
	kg	28	34	40	49	68	88	118	136
Mass Moment of Inertia of the internal rotating parts									
	lb.ft. - Sec²	0.0017	0.0029	0.0044	0.0071	0.0111	0.0170	0.0280	0.0470
	Nm - Sec²	0.0023	0.0039	0.0060	0.0096	0.0150	0.0230	0.0380	0.0640
Charge Inlet Vacuum at Sea Level									
Normal	in. Hg	10							
	BAR (abs.)	.7							
Cold Start	in. Hg	25							
	BAR (abs.)	.2							

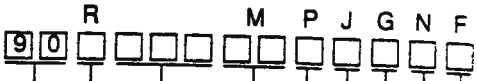
ALL SERIES 90 PUMPS

ALL SERIES 90 PUMPS

ALL SERIES 90 PUMPS

Model Code

Series 90 Variable Displacement Pump — PV



PRODUCT OR SERIES
90 = Series 90, Closed Circuit

R: TYPE AND ROTATION
L = Pump, Left Hand (CCW)
R = Pump, Right Hand (CW)

DISPLACEMENT

042 = 42 cc/rev (2.56 in³/rev)
055 = 55 cc/rev (3.35 in³/rev)
075 = 75 cc/rev (4.57 in³/rev)
100 = 100 cc/rev (6.10 in³/rev)
130 = 130 cc/rev (7.93 in³/rev)

M: CONTROL

042 - 100	130
OPT	N/A
OPT	N/A
STD	STD
OPT	OPT
OPT	N/A
OPT	N/A
OPT	OPT
OPT	N/A
OPT	OPT
OPT	N/A

CA = Cover Plate
DC = 3 Position (F-N-R) Solenoid - 12V DC
MA = Manual Displacement (MDC)
MB = Manual Displ (MDC) w/Neutral Start (NS)
MC = Manual Displ (MDC) w/DC Sol Override - 12 V DC
MD = Manual Displ (MDC) w/NS and DC Sol Override
HA = Hydraulic Displ (HDC)(1 - 11 BAR)
HC = Hydraulic Displ(HDC)(3 - 11 BAR)
EA = Electrical Displ (EDC) w/MS Connector
EP = Electrical Displ (EDC) w/Packard Connector
NOTE: MC and MD Controls require .018, .022, or .026 in. Dia. Control Orifice

P: PRESSURE REGULATION
1 = Pressure Limiter (PL) Range 1 (140-420 BAR) in Port A & B (Standard)
2 = High Pressure Relief Valves (HPRL) in Port A & B - No PL

6 = Pressure Limiter (PL) Range 2 (450-520 BAR) in Port A & B

J: AUXILIARY MOUNTING PAD

042	055	075	100	130
O	O	O	O	O
O	O	O	O	O
N/A	O	O	O	O
N/A	N/A	N/A	N/A	O
STD	STD	STD	STD	STD
O	O	O	O	O
N/A	N/A	O	O	N/A
O	O	O	O	O

A = SAE A w/Sealed Cover
B = SAE B w/Sealed Cover
C = SAE C w/Sealed Cover
D = SAE D w/Sealed Cover
N = No Auxilary Pad
T = SAE A w/Sealed Cover, 11T Shaft
U = SAE B w/Sealed Cover, 19 T Shaft
V = SAE B-B w/Sealed Cover

G: END CAP PORTS (SAE J518c Code 62)

042	055	075	100	130
N/A	O	O	O	N/A
N/A	O	O	O	N/A
N/A	O	O	O	N/A
STD	O	O	O	STD

1 = Twin Ports w/Special Code 61 Flange Halves*
2 = Side Ports w/Special Code 61 Flange Halves*
6 = Side Ports
8 = Twin Ports

N: FILTRATION
S = Suction (Standard)
R = Remote Pressure
P = Pressure Integral (Short Filter)
L = Pressure Integral (Long Filter)

F: DISPLACEMENT LIMIITATION
3 = No Limiters (Standard)
4 = Limitation Both Sides (Factory set at maximum displacement)

Series 90 Variable Displacement Pump (PV)

L H T W V Z K

K: CHARGE PRESSURE SETTING**
18 = 18 BAR (260 PSI)
20 = 20 BAR (290 PSI)
24 = 24 BAR (350 PSI)
28 = 28 BAR (400 PSI)

Z: HIGH PRESSURE SETTING PORT B**
14 = 140 BAR (2030 PSI)
17 = 170 BAR (2460 PSI)
20 = 200 BAR (2900 PSI)
23 = 230 BAR (3300 PSI)
26 = 260 BAR (3770 PSI)
29 = 290 BAR (4200 PSI)
32 = 320 BAR (4640 PSI)
35 = 350 BAR (5070 PSI)
38 = 380 BAR (5510 PSI)
42 = 420 BAR (6090 PSI)
} Range 1 (Standard)

45 = 450 BAR (6530 PSI)
48 = 480 BAR (6960 PSI)
} Range 2

Y: HIGH PRESSURE SETTING PORT A**
(Same setting ranges as above)

W: SPECIAL HARDWARE FEATURES
NNN = None (Welded Pistons)
HNN = Hollow Pistons
NBN = Downhill Kit

T: CONTROL ORIFICE
00 = No Orifice
01 = .018 in. Dia.
22 = .022 in. Dia.
02 = .026 in. Dia.
03 = .032 in. Dia. (Standard)
04 = .040 in. Dia.
05 = .054 in. Dia.
06 = .062 in. Dia.
09 = .092 in. Dia

H: CHARGING SYSTEM

B = 11 cc/rev (.69 in³/rev)
C = 14 cc/rev (.86 in³/rev)
D = 17 cc/rev (1.03 in³/rev)
E = 20 cc/rev (1.20 in³/rev)
F = 26 cc/rev (1.60 in³/rev)
H = 34 cc/rev (2.07 in³/rev)
L = Ext. Charge w/ Int. Relief

042	055	075	100	130
STD	O	N/A	N/A	N/A
O	STD	O	N/A	N/A
N/A	O	STD	O	N/A
N/A	N/A	O	STD	O
N/A	N/A	N/A	O	STD
N/A	N/A	N/A	N/A	O
O	O	O	O	O

L: SHAFT CONFIGURATION

S1 = 14T 12/24 P
S3 = 16T 12/24 P
C3 = 15T 16/32 P
C6 = 21T 16/32 P
C7 = 23T 16/32 P
C8 = 27T 16/32 P
F1 = 13T 8/16 P
K1 = 1.375 in. Str. Key
K2 = 1.500 in. Srt. Key
T1 = 1.375 in. Tapered
T2 = 1.50 in. Tapered
T3 = 1.00 in. Tapered
TF = 13T 8/16P, Taper Spl

042	055	075	100	130
N/A	STD	STD	O+	N/A
N/A	N/A	O	O	N/A
STD	N/A	N/A	N/A	N/A
N/A	O	O	N/A	N/A
N/A	N/A	O	O	N/A
N/A	N/A	N/A	N/A	O
N/A	N/A	N/A	STD	STD
N/A	O	N/A	N/A	N/A
N/A	N/A	O	N/A	N/A
N/A	O	O	N/A	N/A
N/A	N/A	O	O	N/A
O	N/A	N/A	N/A	N/A
N/A	N/A	N/A	O	N/A

STD = Standard
O = Optional
N/A = Not Available
* Patent pending
** All Pressure settings are nominal set pressure at factory test conditions. Actual pressures will vary due to actual conditions.
+ = Not recommended for front pump in tandem configurations.

HYDRAULIC COMPONENT

REFERENCE DWG # 425-8001-01/8009-01

ITEM # HP-3

MANUFACTURER: REXROTH, 2315 CITY LINE ROAD BETHLEHEM, PA 18017-21 215-694-8300

DESCRIPTION: HYDRAULIC PUMP - AXIAL PISTON TYPE

PART NUMBER: A10V028DR/30R-PSC62N00

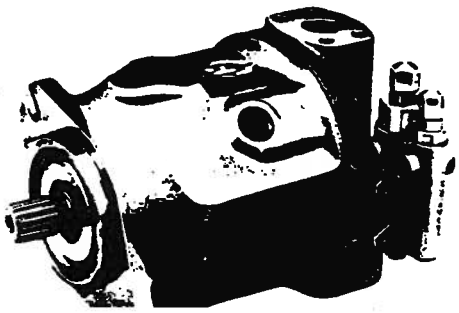
REXROTH
WORLDWIDE HYDRAULICS

Variable Axial Piston Pump, Swashplate Design Model A10VO (Series 30) for Open Circuit Applications

Sizes 28 to 100	...4570 PSI (...315 bar)	...6.1 in³/rev (...100 cm³/rev)

RA 06 281/06.87

- 2-bolt mounting flange to SAE standards
- SAE flanged connections with UNC threads (SAE J 518)
- Special slot-controlled swashplate design
- High power to weight ratio
- Heavy duty roller bearings for extremely long pump life
- Various control options for pressure, flow and power regulation
- Fast response times and low noise level
- Continuous operating pressure of 3625 PSI (250 bar), peak pressure to 4570 PSI (315 bar)
- Axial and radial loading of the drive shaft possible
- Good self-priming suction characteristics
- Cast iron housing, aluminium free construction

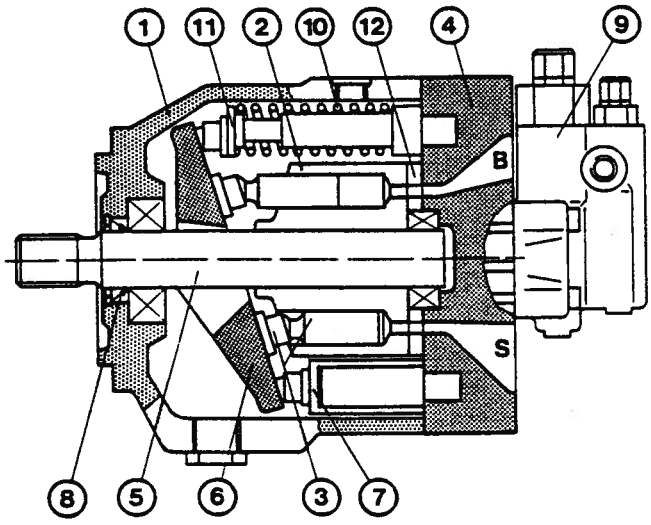


Functional Description

Axial piston pumps model A10VO are swashplate design, variable displacement pumps. They are designed for hydrostatic transmission in open circuit applications. The pump generates fluid flow and imparts to that fluid the necessary pressure forces up to 4570 PSI (315 bar).
They basically consist of the housing (1), cylinder barrel (2), piston and shoes (3), port plate (4), drive shaft (5), swash plate (6), control piston (7), shaft seal (8) and compensator control (9).
Rotation of the drive shaft (5) causes a linear piston movement as the piston shoe (3) slides along the tilted swashplate (6).
As the piston retracts in the cylinder bore (2), fluid fills the developing vacuum cavity from the suction port »S« via the suction kidney in valve plate (12). At maximum retraction of the piston, shaft rotation causes the piston to go beyond the suction kidney and begin communication with the pressure kidney. Continuing rotation then extends the piston into the cylinder bore, forcing fluid into the pressure port »B«.
The stroke length of the piston is directly related to the swashplate angle, which swivels up to a maximum of 17 degrees for stepless flow adjustment.

Pressure and flow regulation

The swashplate is normally held at maximum swivel angle by a spring (10) as well as system pressure working on the stroking piston (11).
System pressure is also working on the pressure compensator against a setting spring. When system pressure overcomes the spring force, the spool shifts allowing system pressure into the control piston (7). This causes the pump to destroke to a regulating point sufficient to maintain compensator set pressure and lubricating fluid flow.
When the pressure setting is reached, only the amount of fluid necessary to satisfy the load conditions is delivered. If the load condition is such that no flow is required, only cooling and lubricating fluid is delivered. Power usage and heating of the fluid are thus kept to a minimum.
When system pressure falls below the compensator setting, which drains control piston (7) to the pump case. The swashplate is then forced on stroke by the spring (10) and stroking piston (11). The flow control spool FR, also known as load sensing control, functions generally the same as the compensator spool. In the case of the FR spool, however, its response is due to a differential pressure across a flow control device. The spring setting only determines the differential pressure required to maintain constant output flow through a given orifice size.
Many control options including constant power control, electronic proportional flow and/or pressure control, etc. are available.



Variable Axial Piston Pump A10VO, Series 30

Ordering Code

A10V	O			/	30		–		S	C		

Hydraulic Fluid

Mineral oil (no designation)

Axial Piston Unit

Variable, swashplate design
Nominal press. 250 bar, peak press. 315 bar — A10V

Function

Pump operation, open circuit — O

Size

Sizes		28	45	71	100
Displacement	in^3/rev	1.71	2.75	4.33	6.10
	(cm^3/rev)	28.0	45.0	71.0	100.0

Control and Control Options

Constant pressure control		DR
Constant pressure/flow control*		DFR
Constant power control **		DFLR
Electrical flow control	FE	FE
	FE D	FED

with pressure compensation

* A bleed orifice to drain is installed in X-port standard; if plug is to be installed state in clear text.
** When ordering please state power requirements in clear text ex. 1 1/2 HP at 1800 rpm (5 kW at 1500 rpm)

Design

Series — 30

Direction of Rotation

Looking at shaft end: clockwise — R; counter clockwise — L

Seals

Perbunan — P
Viton — V

Shaft End

SAE splined — S

Mounting Flange

SAE 2-bolt — C

Service Line and Through Drive Connections

										28	45	71	100	
Pressure port B, Suction port S	SAE on rear side; UNC fixing threads	61	N00							●	●	●		61 N00
Pressure port B, Suction port S	SAE on opposite sides; UNC fixing threads	62	N00							●	●	●	●	62 N00
		62		K01						●	●	●		62 K01
		62			K02						●	●		62 K02
		62				K02				●	●	●		62 K02
		62					K04				●	●		62 K04
		62						K07				●		62 K07

without through drive

Mounting flange	Shaft/coupling	for mounting:
SAE A, 2-bolt	SAE A; splined shaft	G2[1], S15[1], S20[1], A 10 V 16
SAE B, 2-bolt	SAE B; splined shaft	G3[1], S20[1], S30[1]
		A 10 VO 28
SAE B-B, 2-bolt	SAE B-B; splined shaft	A 10 VSO 45
SAE C, 2-bolt	SAE C; splined shaft	A 10 VSO 71

● = available

[1]See the following data sheets, for further infofmations on the combination pumps:
G2- RA 10 030, G3- RA 10 038, S15- RA 64 756, S20- RA 64 774, S30- RA 64 789

draulic Fluid

ject design, please see our catalogue sheet RA 2 detailed information on the selection of mineral oil ed hydraulic fluids and application conditions.

erating viscosity range:

optimum efficiency and pump life, we recommend that operating viscosity (at operating temperature) be selec- in the range of

ν_{opt} = optimum operating viscosity
81...167 SUS (16...36 mm²/s)

ing into consideration the reservoir temperature range.

cosity limits:

e following values are valid for extreme operating condi- ns of short duration.

ν_{min} = 60 SUS (10 mm²/s)
for short periods at max. permissible drainage oil temperature of 194° F (90° C)

ν_{max} = 4635 SUS (1000 mm²/s)
for short periods upon cold start up

Notes on the selection of the hydraulic fluid:

For correct selection of the hydraulic fluid, it is assumed that the operating temperature in the reservoir (open circuits) in relation to the ambient temperature is known.

The hydraulic fluid should be selected so that, within the operating temperature range, the operating viscosity lies within the optimum range ν_{opt} (see shaded area of selection diagram). We recommend that the higher viscosity grade is selected in each case.

Example: At some ambient temperature of X°, the operating temperature in the reservoir is 140° F (60° C). In the optimum operating viscosity range (ν_{opt}, shaded section), this corresponds to viscosity grades VG 46 or VG 68; VG 68 should be selected.

Important: The drainage fluid temperature is influenced by pressure and speed and is always higher than the reservoir temperature. At no point in the system, however, must the temperature be higher than 194° F (90° C).

If it is not possible to comply with the above conditions because of extreme operating parameters or high ambient temperature, please consult us.

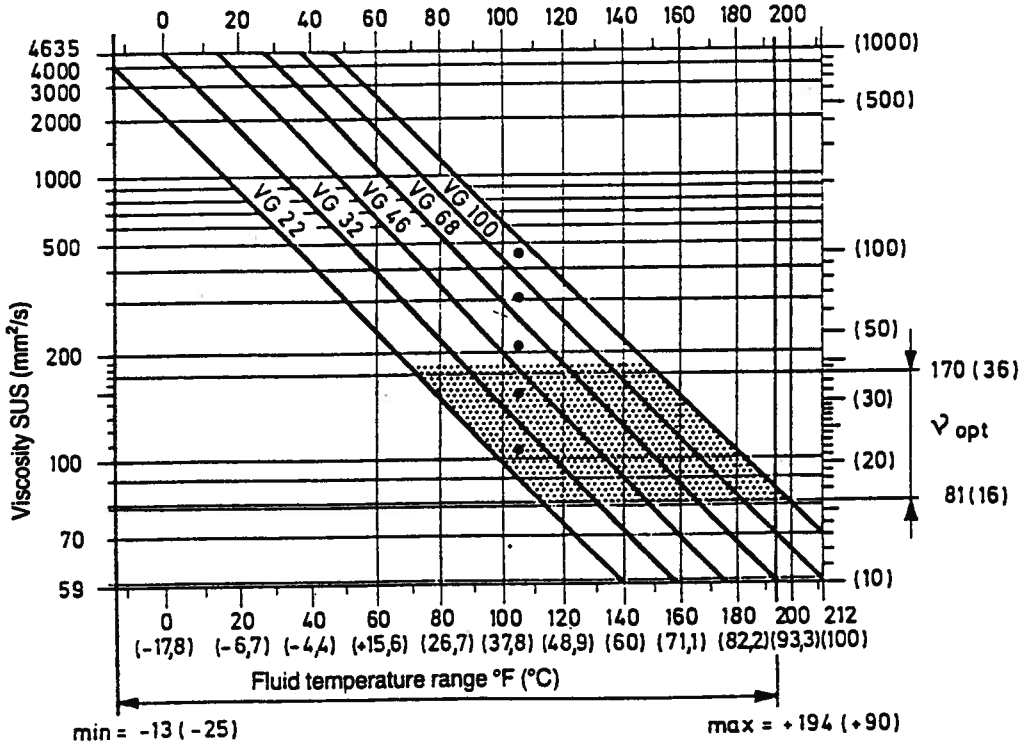
Filtration

In order to guarantee proper and reliable function, the operating fluid must be maintained to a minimum cleanliness grade of 9 to NAS 1638, 6 to SAE, ASTM, AIA or ISO grade 16/15.

This can be achieved, e.g., with filter elements type ... D 020 ... (see RA 31 278).

A beta value of $\beta_{20} \geq 100$ is thereby achieved.

lection Diagram



Technical Data

Operating pressure range – Inlet Side

Absolute pressure at port S (suction inlet)

$p_{abs\ min}$ ——— 12 PSIA (0.8 bar)
$p_{abs\ max}$ ——— 435 PSIA (30 bar)

Operating pressure range – Outlet Side

Pressure at port B

Nominal pressure p_N ——— 3625 PSI (250 bar)
Peak pressure p_{max} ——— 4570 PSI (315 bar)

Drainage fluid:

Maximum permissible pressure of the case drain (port L): 7 PSI (0.5 bar) maximum higher than inlet pressure at port »S«, but not higher than 30 PSI (2 bar) absolute.

Direction of flow:

Port »S« to port »B«

Speed in relation to inlet pressure and displacement:

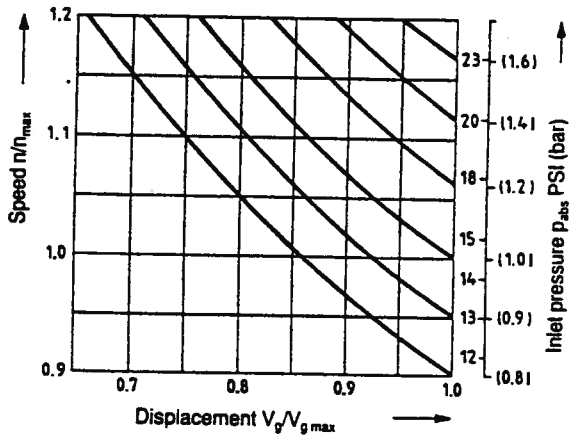


Table of Values

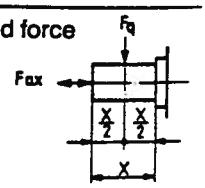
Theoretical values, without considering mechanical η_{mh} and volumetric η_v efficiencies

Size				28	45	71	100
Displacement: $V_{g\ max}$			in³/rev (cm³)	1.71 (28)	2.75 (45)	4.33 (71)	6.10 (100)
Nominal flow*:							
at n_E = 1750 rpm			GPM (l/min)	12.7 (48)	20.1 (76)	32.0 (121)	45.0 (170)
at $n_{o\ max}$			GPM (l/min)	21.4 (81)	29.9 (113)	40.2 (152)	51.3 (194)
Maximum speed**: (flooded suction)		$n_{o\ max}$	rpm	3000	2600	2200	2000
Max. power:	$-n_E$ = 1750 rpm		HP (kW)	20.4 (15.2)	32.8 (24.5)	51.8 (38.6)	72.9 (54.4)
Δp = 3625 PSI (250 bar)	$-n_{o\ max}$	$P_{o\ max}$	HP (kW)	35 (26.1)	48.8 (36.4)	65.1 (48.5)	83.3 (62.1)
Max. torque:	Δp = 3625 PSI (250 bar)		lb-ft (Nm)	81.9 (111)	132 (179)	208 (282)	293 (397)
Torque	Δp = 1450 PSI (100 bar)		lb-ft (Nm)	33 (45)	53 (72)	83 (113)	117 (159)
Moment of inertia about the drive axis		J	lb-ft² (kgm²)	0.0403 (0.0017)	0.0783 (0.0033)	0.1968 (0.0083)	0.3960 (0.0167)
Filling volume:			Pints (l)	1.48 (0.7)	2.11 (1.0)	3.38 (1.6)	4.64 (2.2)
Weight: (approx)			lbs (kg)	33.0 (15)	46.2 (21)	72.6 (33)	99 (45)
Permissible loading on drive shaft: (see below)							
max. axial force F_{ax}			lbs (N)	225 (1000)	337 (1500)	540 (2400)	900 (4000)
max. radial force F_q			lbs (N)	540 (2400)	810 (3600)	1350 (6000)	2250 (10000)
Mounting Position:				See page 5			
Fluid temperature range:				See diagram, page 3			
Viscosity range:	SUS (mm²/S)			60-4640 (10...1000) Optimum 81-167 (16...36)			

* 3% loss of volume included

** The values shown are measured with an absolute pressure of 14.5 PSI (1 bar) at the suction inlet «S»

Direction of applied force



Sizing Calculations

Flow $Q = \frac{V_g \cdot n \cdot \eta_v}{231}$ $(Q = \frac{V_g \cdot n \cdot \eta_v}{1000})$

Drive torque $M = \frac{V_g \cdot \Delta p}{24 \cdot \pi \cdot \eta_{mh}}$ $(M = \frac{1.59 \cdot V_g \cdot \Delta p}{100 \cdot \eta_{mh}})$

Drive power $P = \frac{M \cdot n}{5252} = \frac{Q \cdot \Delta p}{1714 \cdot \eta_t}$

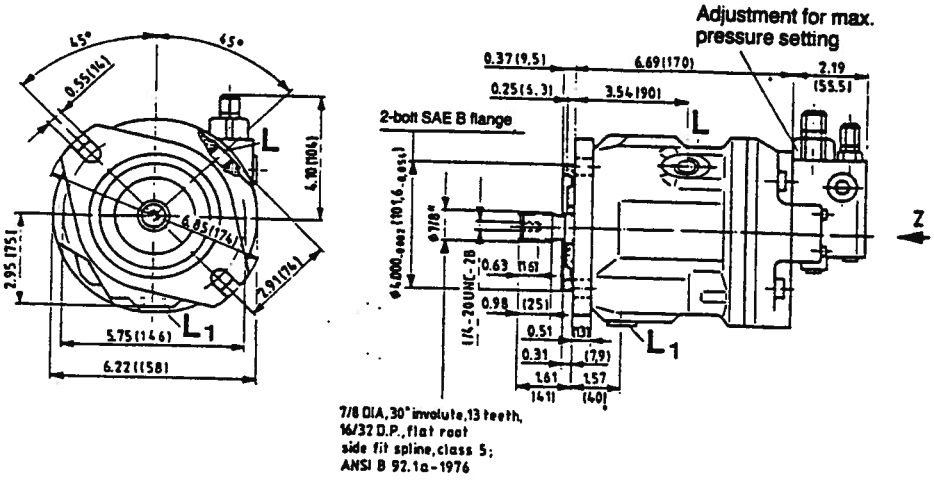
$(\frac{2\pi \cdot M \cdot n}{60000} = \frac{M \cdot n}{9549} = \frac{Q \cdot \Delta p}{600 \cdot \eta_t})$

V_g = geom. displacement in³/rev (cm³/rev)
Δp = pressure differential PSI (bar)
M = torque lb-ft (Nm)
Q = flow GPM (l/min)
P = drive power HP (kW)
n = speed rpm
η_v = volumetric efficiency
η_{mh} = mechanical efficiency
η_t = overall efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

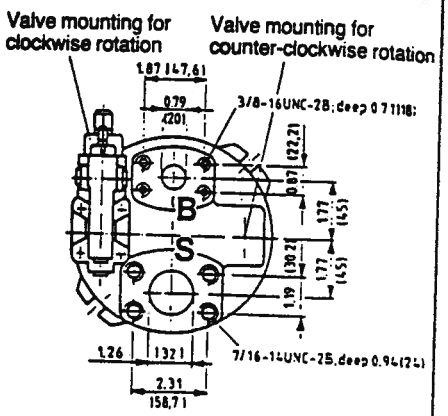
Unit dimensions, Size 28

Service ports at rear, without through drive
Model **61 N00**

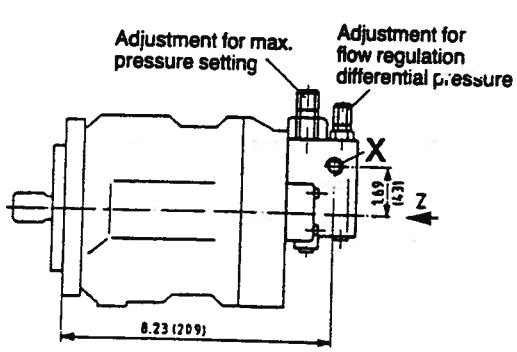
Constant pressure compensator DR



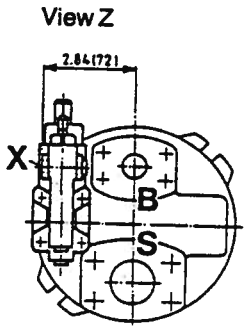
View Z



Constant pressure/flow compensator DFR



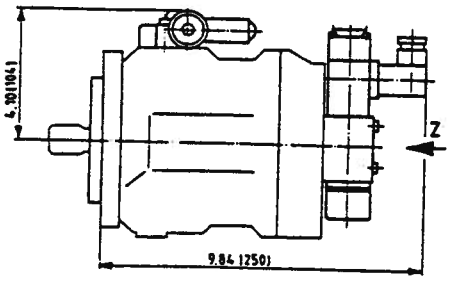
View Z



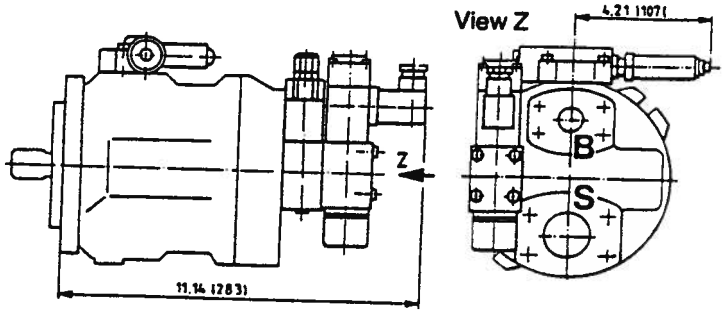
Constant pressure/flow/power control DFLR

only available for pump with service ports on side (type 62) – see page 13.

Electrical flow control FE



Electrical flow control with pressure compensation FED



Port connections

B	pressure port:	3/4" SAE flange (standard pressure range)
S	suction port:	1 1/4" SAE flange (standard pressure range)
X	pilot pressure port:	(for DFR and DFLR) 7/16-20 UNF-2B; deep 0.39(10)
L, L_1	case draining ports:	3/4-16 UNF-2B

ELECTRICAL COMPONENT

REFERENCE DWG #425-9001-01/9009-0

ITEM # 102

MANUFACTURER: SUNDSTRAND, 2800 E. 13TH ST ANES. IOWA 50010 515-239-6000

DESCRIPTION: CONTROL

PART NUMBER: MCH51AB1174

ORDERING INFORMATION

The following tabulation is the list of current standard production Control Handle models for EDCs. ...and each circuit (as described in the Electrical Characteristics section of this bulletin) is the mounting, knob, and actuation which are available as production models. For example, for the B1039 circuit there is MCH12AB1039, MCH41AB1039, and MCH51AB1039 in production. Other combinations may be possible. Consult factory for availability.

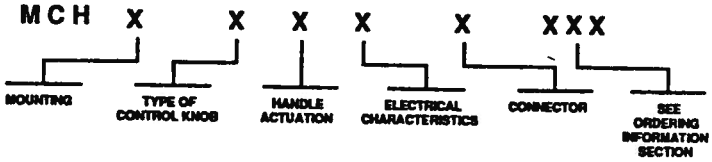
CIRCUIT NUMBER	MOUNTING, KNOB AND ACTUATION
B1032	11A 11B 12A 12B 21A 22A 22B 23A 29A 31A 41A 41B 42A 42B 48B 51A
B1035	11C 21C 31C 31C 51C 59C
B1039	12A 41A 51A
B1042	11A 11B 12B 21A 22A 22B 23A 41A 42A 48A
B3069	12A 32B 41A
B5087	11B 41A
B5093	12B
C1033	11A 11B 12A 12B 13A 22A 22B 32B 41A 41B 42A 42B 43A 52B 53A
C1065	22B
C1067	12B 22B 32A 42B
C5168	42B
D1029	11B 22B 29B
D1040	19A
D1043	11A 11B 12B 13A 21A 22B 23A 26B 29B 41A 41B 42B 52B
D1058	11A 11B 12B 21B 22B 23A 41B 42B 48A 52B
D1064	11A 11B 12A 22B 41A 48A

ORDERING INFORMATION *(continued)*

CIRCUIT NUMBER	MOUNTING, KNOB AND ACTUATION
D1073	11B 12B 21A 21B 22B 41B 52B
D1077	21B 22B 51B
D1082	22B 42B
D1089	42B
D2155	48A
D3059	11B
D5129	11A 11B 41A 41B
L2171	11A 42B

CIRCUIT NUMBER	MOUNTING, KNOB AND ACTUATIO
M1041	11B 12B
M1068	12B 21A 21B 22A 22B 29B 41B 28A
M1083	11A 12B 21A 41A 51A 52B
M1101	41B
M1112	41B 52B
M1122	41B 48A
M1167	51B
M1169	41B

MCHXXX ORDERING SPECIFICATION CHART



MOUNTING

1 Base (surface) mount aluminum case
2 Top mount (drop-in) with plastic case
3 Top mount (drop-in) without plastic case
4 Panel mount with plastic case
5 Panel mount without plastic case

TYPE OF CONTROL KNOB

1 Non-locking
2 Center lock
3 Push button in knob
4 Tron maintained rocker switch
5 Non-locking, no knob
6 3-position maintained rocker switch in knob
7 Tron momentary rocker switch
8 Special (no handle or knob)
9 3-position momentary rocker switch in knob

HANDLE ACTUATION

A Spring-return, bi-directional
B Friction held, bi-directional
C Friction held, uni-directional
D Special (friction held, center detent only, no brake)

ELECTRICAL CHARACTERISTICS

A Proportional, no switches
B Proportional, 12 Vdc center-off switch
C Proportional, 24 Vdc center-off switch
D Proportional, center-off and auxiliary switch
L Electronic PWM auxiliary switching
M 3-switches
X Special
Y Special
Z Special

CONNECTOR

1 Terminal strip internal
2 Pigtail 60 inch with no connector
3 Pigtail with unsealed Packard connector
4 Pigtail with both halves of unsealed Packard connector
5 Sealed Packerd connector with mating half
6 Sealed Packard connector 4-pin male and female
7 Pigtail with sealed Packard connector

:CHNICAL DATA

:CTRICAL SPECIFICATIONS

:RATING VOLTAGE RANGE
-15 Vdc (12 Volt models)
) Vdc (12 Volt proportional transmission controller models)
:-30 Vdc (24 Volt models)
) Vdc (24 Volt proportional transmission controller models)

D RESISTANCE
-30 Ω
uer-Sundstrand single and dual-coil Electrical Displacement Controls.

ILIARY SWITCH CURRENT CAPABILITY
IL Microswitch (cam actuated)
amp, Inductive at 28 Vdc

/ Microswitch (cam actuated)
i-amp, Inductive at 28 Vdc

cker Switch (in knob)
mp, Inductive at 28 Vdc

sh button Switch (in knob)
mp, Inductive at 28 Vdc

MECHANICAL SPECIFICATIONS

HANDLE STROKE:
±30°
60° total travel

SPRING TORQUE
11 ± 4-in./lb. (1.2 ± 0.4-N-m) at center break away
18 ± 6-in./lb. (2.0 ± 0.7-N-m) at full stroke

DETENTE TORQUE (over & above friction drag):
10-in./lb. (1.1-N-m)

FRICTION DRAG:
13.5 ± 3-in./lb. (1.5 ± 0.3-N-m)
Friction is adjusted at brake assembly with a 5/32 English Allen wrench and 3/8 open-ended wrench.

UNTING, TYPE OF KNOB, HANDLE ACTUATION

e range of options to the basic Control Handle allows it stom-tailored to each application. See Ordering Specin chart in Ordering Information.

NTING (See Dimension Drawing)

ASE OR SURFACE MOUNT
onnection is via four screws to the flanges on the ottom of the metal case.

OP MOUNT WITH CASE
onnection is via two screws to an enlarged mounting late. Top mounting allows the entire handle to be moved from above the panel. The case is made of lack nylon plastic.

OP MOUNT WITHOUT CASE
ame as 2, but without case.

ANEL MOUNT WITH CASE
onnection is via four screws to the top plate that holds e boot in place. The case is made of black nylon astic.

ANEL MOUNT WITHOUT CASE
ame as 4, but without case.

TYPE OF CONTROL KNOB (See Dimension Drawing)

1. NON-LOCKING
The non-locking handle has a standard ball knob. The friction-held handle detents with a spring-loaded ball to indicate null, while the spring-return handle has a spring-preload indicating null.

2. CENTER-LOCK
The center-lock handle has a cylindrical knob and provides a positive center-lock that unlatches when the operator pulls up on the knob.

3. NON-LOCKING, AUXILIARY SWITCH
This knob is teardrop shaped, with an auxiliary momentary push button switch on top. The switch is wired through the handle shaft to the body with three wires (common, normally open and normally closed).

5. NON-LOCKING, NO KNOB
The customer provides has own customized knob.

6. THREE POSITION MAINTAINED ROCKER SWITCH IN KNOB
The cylindrical knob has a boot covering the three position switch in the knob. The switch, wired through the handle, is used for auxiliary functions.

9. THREE POSITION MOMENTARY ROCKER SWITCH IN KNOB
This is the same as 6, but the switch returns to the center position when released.

HANDLE ACTUATION *(continued)*

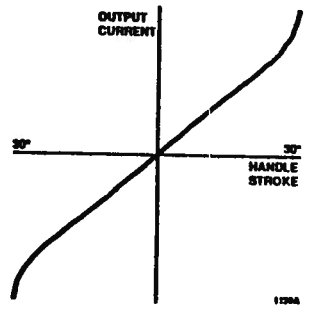
HANDLE ACTUATION

A. SPRING-RETURN, BI-DIRECTIONAL
This handle uses a torsion spring to return to the mechanical center position, and has 30 degrees of handle throw on either side of center.

B. FRICTION-HELD, BI-DIRECTIONAL
This handle has an adjustable drag set with a clamp-type brake, that holds the handle at the set position, and has 30 degrees of handle throw on either side of the center detent.

C. FRICTION-HELD, UNI-DIRECTIONAL
This handle has a high-resolution 60 degrees of handle throw, rotating on only one side of mechanical null, which is at full stroke. It has no detent mechanism.

PERFORMANCE CURVE



Proportional Control Handle Output Current vs. Control Handle Travel.

ELECTRICAL CHARACTERISTICS

A. PROPORTIONAL, NO SWITCHES, 12 Vdc, BI-POLAR
Not recommended for Control Handle's driving an Electrical Displacement Control. To be used only as setpoint. See Performance Curve.

B. PROPORTIONAL, CENTER-OFF SWITCH, 12 Vdc, BI-POLAR
These handles have a center-off switch wired to ensure zero output when the handle is within ±3° of mechanical center.

CIRCUIT NUMBERS FOR USE WITH A FIXED POWER SUPPLY
B1032 - Single pot, terminal strip
B2095 - Single pot, pigtail no connector
B3069 - Single pot, unsealed Packard connector
B5093 - Single pot, sealed Packard connector

CIRCUIT NUMBERS FOR USE WITH THE MCE101 PROPORTIONAL TRANSMISSION CONTROLLER
B1042 - Dual pot, terminal strip
B3086 - Dual pot, unsealed Packard connector
B5087 - Dual pot, sealed Packard connector

CIRCUIT FOR OPERATING TWO EDCs IN SERIES
B1039 - Dual pot, terminal strip

C. PROPORTIONAL, CENTER-OFF SWITCH, 24 Vdc, BI-POLAR
These handles have a center-off switch wired to ensure zero output when the handle is within ±3° of mechanical center.

CIRCUIT NUMBERS FOR USE WITH A FIXED POWER SUPPLY
C1033 - Single pot, terminal strip
C3076 - Single pot, unsealed Packard connector
C5168 - Single pot, sealed Packard connector

CIRCUIT NUMBERS FOR USE WITH THE MCE101 PROPORTIONAL TRANSMISSION CONTROLLER
C1067 - Dual pot, terminal strip

CIRCUIT FOR OPERATING TWO EDCs IN SERIES
C1065 - Dual pot, terminal strip

D. PROPORTIONAL, CENTER-OFF SWITCH, UNWIRED AUXILIARY SWITCH, 12 OR 24 Vdc, BI-POLAR

CIRCUIT NUMBERS FOR USE WITH FIXED 12 Vdc POWER SUPPLY
D1043 - Single pot, reverse switch, terminal strip
D1058 - Single pot, neutral start switch, terminal strip
D2163 - Single pot, neutral start switch, 60" pigtail
D3059 - Single pot, reverse switch, unsealed Packard connector

CIRCUIT NUMBERS FOR USE WITH FIXED 24 Vdc POWER SUPPLY
D1040 - Single pot, reverse switch, terminal strip
D1082 - Single pot, neutral start switch, terminal strip

CIRCUIT NUMBERS FOR USE WITH 12 Vdc MCE101 PROPORTIONAL TRANSMISSION CONTROLLER
D1029 - Dual pot, reverse switch, terminal strip
D1064 - Dual pot, neutral start switch, terminal strip
D2155 - Dual pot, neutral start switch, 60" pigtail
D5129 - Dual pot, neutral start switch, sealed Packard connector

CIRCUIT NUMBERS FOR USE WITH 24 Vdc MCE101 PROPORTIONAL TRANSMISSION CONTROLLER
D1077 - Dual pot, neutral start switch, terminal strip

CIRCUIT FOR OPERATING TWO EDCs IN SERIES
D1073 - 12 Vdc, dual pot, neutral start switch, terminal strip
D1089 - 24 Vdc, dual pot, reverse switch, terminal strip
D1138 - 24 Vdc, dual pot, neutral start switch

ELECTRICAL CH. ..CTERISTICS *(continued)*

ELECTRONIC, PULSE WIDTH MODULATED, ADJUSTABLE OUTPUT, 12 Vdc, BI-POLAR

RCUIT NUMBERS FOR USE WITH AN ELECTRICAL SPLACEMENT CONTROL
L2171 - Center off and output phasing switch, suitable for fixed or variable power supplies.

PROPORTIONAL, THREE SWITCHES, 12 OR 24-VOLT
The three switches include a wired center-off switch and two unwired auxiliary switches.

RCUIT NUMBERS FOR USE WITH 12 Vdc FIXED OWER SUPPLY
M1068 - Single pot, forward & reverse switches, terminal strip
M1101 - Single pot, forward & neutral start switches, terminal strip

RCUIT NUMBERS FOR USE WITH 24 Vdc FIXED OWER SUPPLY
M1083 - Single pot, forward & reverse switches, terminal strip

CIRCUIT NUMBERS FOR USE WITH 12 Vdc MCE101 PROPORTIONAL TRANSMISSION CONTROLLER
M1122 - Dual pot, forward & neutral start switches, terminal strip
M1167 - Dual pot, forward & reverse switches, terminal strip
M2151 - Dual pot, forward & neutral start switches, 60" pigtail

CIRCUIT NUMBERS FOR USE WITH 24 Vdc MCE101 PROPORTIONAL TRANSMISSION CONTROLLER
M1169 - Dual pot, forward & reverse switches, terminal strip

CIRCUIT NUMBERS FOR OPERATING TWO EDCs IN SERIES
M1091 - Dual pot, 12 Vdc, forward & reverse switches, terminal strip
M1112 - Dual pot, 24 Vdc, forward & reverse switches, terminal strip

ONNECTORS

RMINAL STRIP
Electrical connectors are made to a set of four internal crew terminals.

TAIL WITHOUT A CONNECTOR
0 inch lead wire, total length.

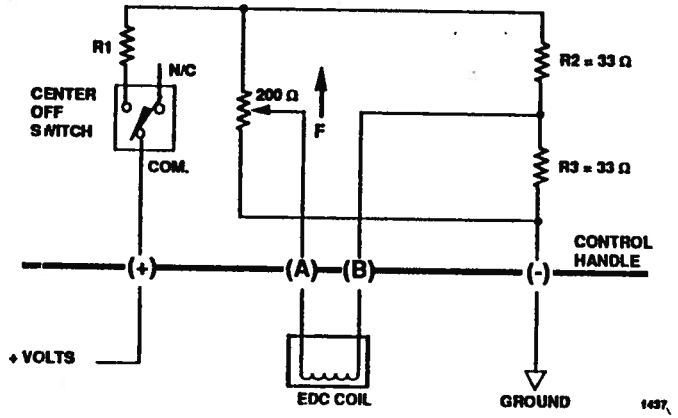
TAIL WITH UNSEALED PACKARD CONNECTOR
2 inch lead wire with unsealed Packard connector. Unsealed connectors are generally used inside a sealed anel.

PIGTAIL WITH UNSEALED PACKARD CONNECTOR
Halves of the connector are included.

SEALED PACKARD CONNECTOR WITH MATING HALF
A weather-sealed Packard connector and unassembled mate.

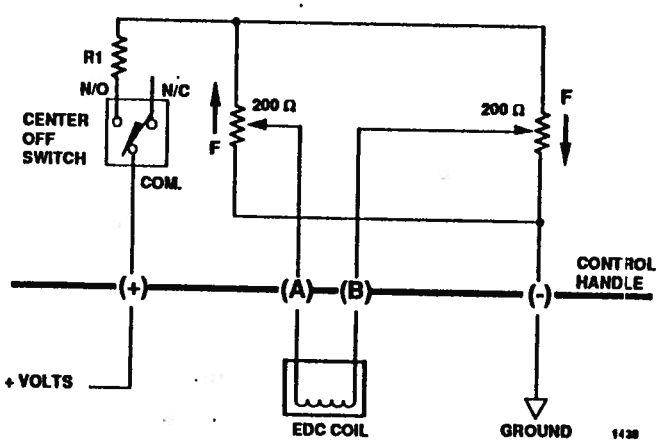
SEALED PACKARD CONNECTORS
(4-pin male & female) These are two separate connectors, each connected to a separate potentiometer bridge.

.OCK DIAGRAM 1



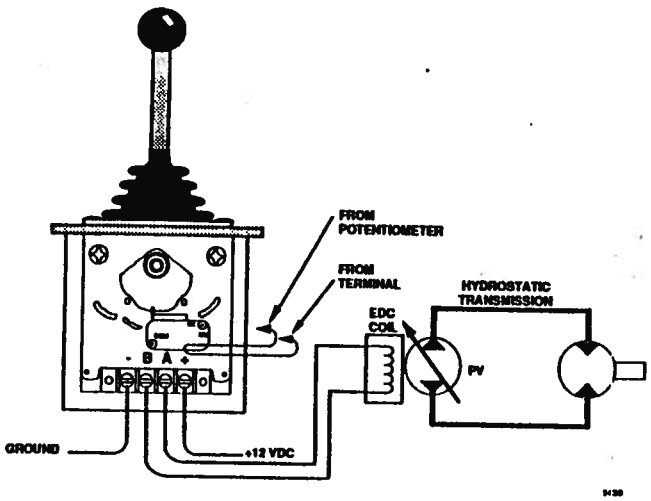
Single Potentiometer Control Handle Circuit (Bi-Directional Output).

BLOCK DIAGRAM 2



Dual Potentiometer Control Handle Circuit (Bi-Directional Output).

CONNECTION DIAGRAM



Typical Connection Diagram.

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
–	A	ADDED HOSE LENGTHS	10/30/95	JED

NOTES:

1. REFERENCE LINE NUMBERS TO SQUARE CALLOUTS ON DRAWING No. 425–8001–01.
2. ALL TUBING IS SEAMLESS, TYPE 304 STAINLESS STEEL.
3. ALL HOSES ARE IDENTIFIED BY DAYCO PART NUMBERS.
4. ALL HOSES ARE DESIGNED FOR 4:1 SAFETY FACTOR.
5. ALL TUBING IS DESIGNED FOR 6:1 SAFETY FACTOR.
6. ALL PIPING IS DESIGNED FOR 6:1 SAFETY FACTOR.

425–8001–01	1
NEXT ASSY	QUANTITY
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS DECIMALS ANGLES
±1/16 XX ±.02 ±1/2°
.XXX±.005
REMOVE BURRS, BREAK SHARP EDGES.
MATERIAL

FINISH 125 | APPROX. WT. LBS

DO NOT SCALE DRAWING

CUSTOMER P.O. No. | DYNACON JOB No. 425

APPROVALS		DATE
DRAWN	PRC	07/27/95
DRAFTING CHECK	DRB	08/01/95
ENGINEERING CHECK	JED	08/03/95
ENGINEERING APPROVAL	JRJ	08/04/95
PRODUCTION APPROVAL	JRJ	08/04/95

DYNACON, INC.
831 INDUSTRIAL BLVD.
BRYAN, TEXAS USA 77803

TRACTION WINCH SYSTEM FLOW LINE SCHEDULE

SIZE	CAGE CODE	DWG NO.	REV
A	OFSDO	425–8009–02	A

SCALE 1/1 | FILE J:\425\42580902 | SHEET 1 OF 3

08/01/95 14:33

REFERENCE DRAWING NUMBER:425-8001-01 APPROVED: JSD

LINE NO.	HOSE OR TUBE TYPE	PRESSURE RATING, PSIG	LENGTH INCHES
1	20C-20FJ20SH-20FJ20SH	200	61
2	4BX-4FJ4SB-4FJ4SB	5000	31
3	8MX-8FJ8SB-8FJ8SB	2000	57
4	4BX-4FJ4SB-4FJ4SB	5000	76
5			
6	4BX-4FJ4SB-4FJ4SB	5000	55
7			
8	6HT6-6FJ6BW-6FJ6BW	6000	70
9	6HT6-6FJ6SB-6FJ6BW	6000	64
10	16HT6-16FJ16BW-16FJ16BW	6000	54
11	16HT6-16FJ16BW-16FJ16BW	6000	54 1/2
12	6MX-6FJ6SB-6FJ6SB	2250	64 1/2
13	6HT6-6FJ6BW-6FJ6BW	6000	124
14	6HT6-6FJ6BW-6FJ6BW	6000	123
15	16MX-16FJ16SB-16FJ16SB	1000	97
16	4BX-4FJ4SB-4FJ4SB	5000	79
17	4BX-4FJ4SB-4FJ4SB	5000	85
18	8MX-8FJ8SB-8FJ8SB	2000	61
19			
20	6BX-6FJ6SB-6FJ6SB	4000	56 1/2
21	12CE-12FJ12BW-12FJ12BW	4000	40 1/2
22	4BX-4FJ4SB-4FJ4SB	5000	126
23	4BX-4FJ4SB-4FJ4SB	5000	123
24	12CE-12FJ12BW-12FJ12BW	4000	40 1/2
25	6BX-6FJ6SB-6FJ6SB	5000	52
26	6MX-6FJ6SB-6FJ6SB	2250	57
27			
28	12MX-12FJ12SB-12FJ12SB	1250	86

REFERENCE DRAWING NUMBER:425-8001-01 APPROVED:

LINE NO.	HOSE OR TUBE TYPE	PRESSURE RATING, PSIG	LENGTH INCHES
29	16C-16FJ16SH-16FJ16SH	250	48
30	8MX-8FJ8SB-8FJ8SB	2000	56
31	2215-1140	150	41
32	8MX-8FJ8SB-8FJ8SB	2000	57
33	2215-1150	150	51
34	2215-1150	150	54
35			
36	8BX-8FJ8SB-8FJ8SB	3500	31
37	8BX-8FJ8SB-8FJ8SB	3500	30
38	4BX-4FJ4SB-4FJ4SB	5000	115
54	16HT6-16FJ16BW-16FJ16BW	6000	600
55	16HT6-16FJ16BW-16FJ16BW	6000	600
56	4BX-4FJ4SB-4FJ4SB	5000	600
57	8MX-8FJ8SB-8FJ8SB	2000	600
58	12HT6-12FJ12BW-12FJ12BW	6000	116
59	12HT6-12FJ12BW-12FJ12BW	6000	125
60	12HT6-12FJ12BW-12FJ12BW	6000	48
61	4BX-4FJ4SB-4FJ4SB	5000	112
62	4BX-4FJ4SB-4FJ4SB	5000	41 1/2
63	12HT6-12FJ12BW-12FJ12BW	6000	51
64	12MX-12FJ12SB-12FJ12SB	2000	117
65	12MX-12FJ12SB-12FJ12SB	2000	57
66	304 ST. ST. TUBING .250 x .035 Wall	3500	AS REQUIRED
67			
68			
69			
70			
71			

NOTES:

1. REFERENCE TAG NUMBERS TO CALLOUTS ON DRAWING No. 424-8001-01.
2. SEE DRAWING No. 424-8009-02 FOR FLOW LINE SCHEDULE.

424-8001-01	1
NEXT ASSY	QUANTITY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS DECIMALS ANGLES
±1/16 .XX ±.02 ±1/2°
.XXX±.005
REMOVE BURRS, BREAK SHARP EDGES.

MATERIAL

FINISH 125 | APPROX. WT. LBS

DO NOT SCALE DRAWING

CUSTOMER P.O. No.	DYNACON JOB No. 424
APPROVALS	DATE
DRAWN PRC	08/01/95
DRAFTING CHECK DRR	9/25/95
ENGINEERING CHECK DED	9/25/95
ENGINEERING APPROVAL DAL	9/25/95
PRODUCTION APPROVAL	9/25/95

THIS DRAWING IS THE PROPERTY OF

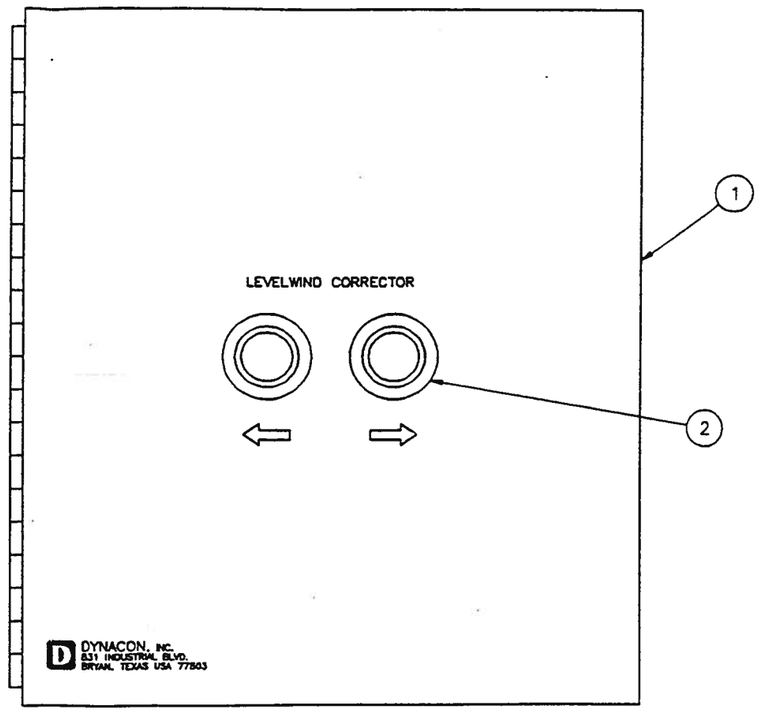
DYNACON, INC.
831 INDUSTRIAL BLVD.
BRYAN, TEXAS USA 77803

LEVELWIND & STORAGE WINCH COMPONENT SPECIFICATION

SIZE	CAGE CODE	DWG NO.	REV
A	OFSDO	424-8009-01	–

SCALE 1/1 | FILE J:\424\42480901 | SHEET 1 OF 4

09/25/95 13:02



QTY REQD	PART NUMBER	DESCRIPTION	MATERIAL SPECIFICATION	ITEM NO.
2	52PA8	PUSH BUTTON	FURNAS	2
1	DYN-9002-07	LEVELWIND CONTROL PANEL ENGRAVING		1

PARTS LIST

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES
TOLERANCES ARE: FRACTIONS ±1/16 DECIMALS .XX ±.02 .XXX ±.005 ANGLES ±1/2
REMOVE BURRS, BREAK SHARP EDGES.
MATERIAL: SEE PARTS LIST
FINISH 125 / APPROX. WEIGHT, LBS
DO NOT SCALE DRAWING

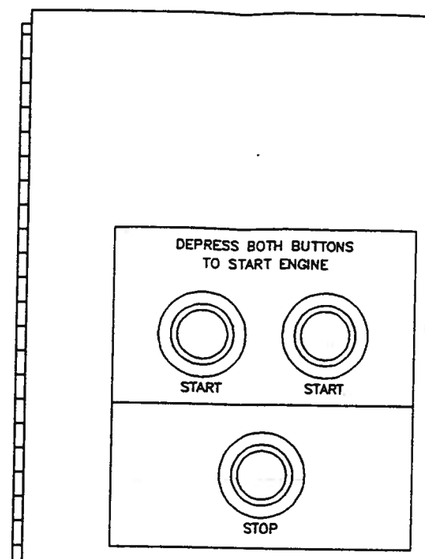
CUSTOMER P.O. No. | DYNACON JOB No. 424

APPROVALS		DATE
DRAWN	ALN	08/14/95
DRAFTING CHECK	DRB	8/15/95
ENGINEERING CHECK	Dwl	8-21-95
ENGINEERING APPROVAL	TW	9/21/95
PRODUCTION APPROVAL	RJS	8-17-95

424-2001-02 | 1
NEXT ASSEMBLY | QUANTITY
APPLICATION

LEVELWIND CONTROL PANEL ASSEMBLY

SIZE C | CAGE CODE OFSDO | DWG NO. DYN-9002-06 | REV –
SCALE 1/2 | FILE D:\DYN\DYN90206 | SHEET 1 OF 1



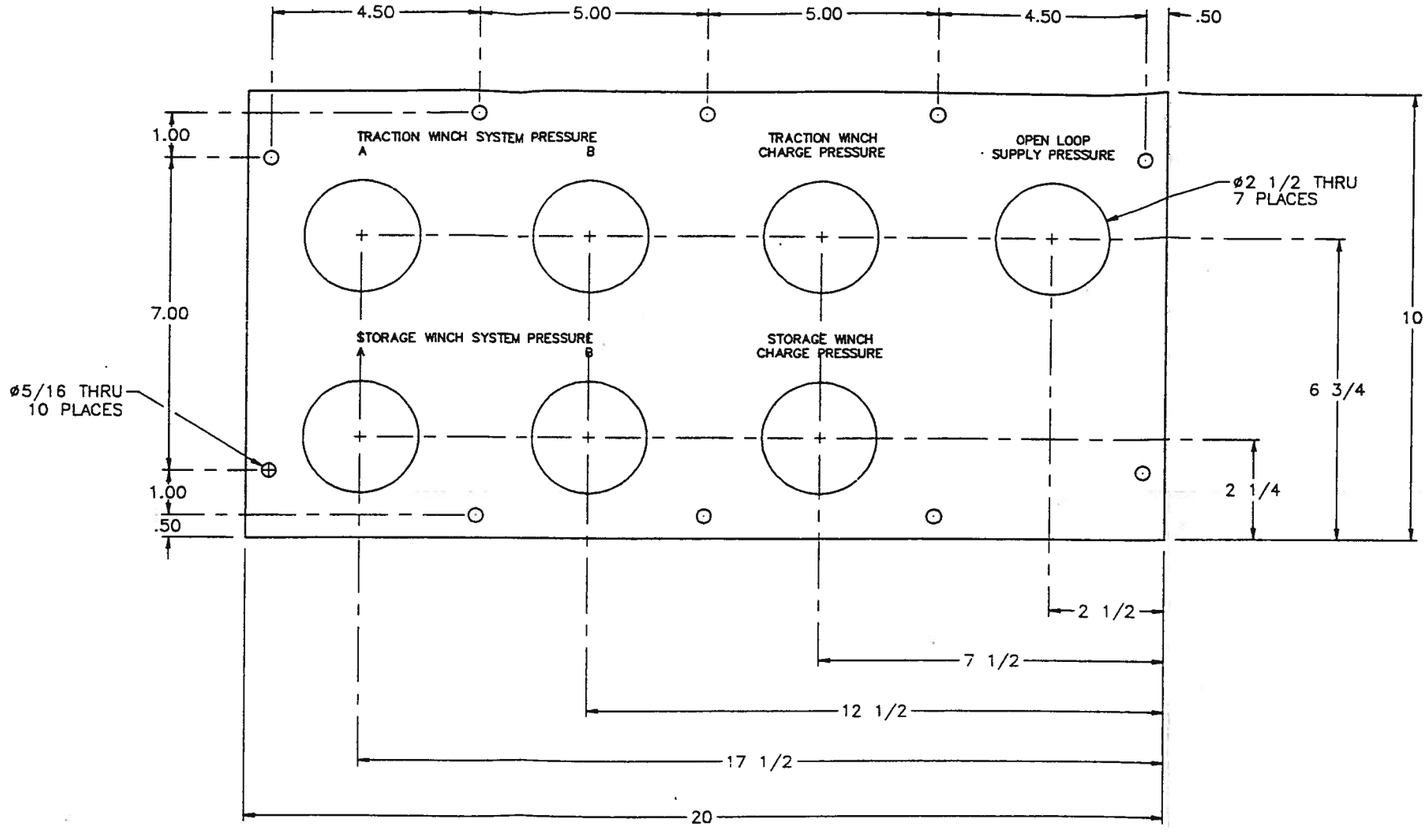
DYNACON, INC.
831 INDUSTRIAL BLVD.
BRYAN, TEXAS USA 77803

		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ±1/16 DECIMALS .XX ±.02 .XXX±.005 ANGLES ±1/2° REMOVE BURRS, BREAK SHARP EDGES.	CUSTOMER P.O. No.	DYNACON JOB No. 425	THIS DRAWING IS THE PROPERTY OF DYNACON, INC. 831 INDUSTRIAL BLVD. BRYAN, TEXAS USA 77803 ANY REPRODUCTION OR USE OF THIS DESIGN IS EXPRESSLY FORBIDDEN UNLESS AUTHORIZED IN WRITING.
			APPROVALS	DATE	
			DRAWN ALN	08/14/95	HYDRAULIC POWER UNIT STARTER PANEL
		MATERIAL 425-9002-07	DRAFTING CHECK DRB	8/17/95	
425-9009-01	1		ENGINEERING CHECK DAL	8.21.95	
NEXT ASSEMBLY	QUANTITY	FINISH 125 APPROX. WEIGHT, LBS	ENGINEERING APPROVAL T	8/21/95	SIZE C CAGE CODE OFSDO DWG NO. 425-9002-05 REV —
APPLICATION		DO NOT SCALE DRAWING	PRODUCTION APPROVAL MAS	8-17-95	SCALE 1/2 FILE J:\425\42590205 SHEET 1 OF 1

08/17/95 09:05

NOTES: UNLESS OTHERWISE SPECIFIED
1. USE AutoCAD ELECTRONIC FILE FOR ENGRAVING.
2. PAINT RECESSED CHARACTERS BLACK.
3. PASSIVATE PANEL.

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	PER DCN DATED 08/02/95	08/03/95	



AutoCAD LAYERING CONVENTION			
LAYER NAME	DESCRIPTION	TOOL SIZE	DEPTH
010	3/32" TEXT	.010"	.012"
020	1/8" TEXT	.020"	.012"
025	3/16" TEXT	.025"	.012"
040	1/4" TEXT	.040"	.012"
HOLE_CEN	HOLE CENTER POSITIONS	.040"	.012"
DISPLAY_HOLE	ENGRAVED CUTOUT HOLES	.025"	.005"
HOLE	PANEL CUTOUT HOLE	N/A	N/A
PARTS	SWITCHES, BUTTONS, LIGHTS	N/A	N/A
ALL OTHERS	MISC.	N/A	N/A

425

425-9002-06	1
~~265-3001-01~~	~~1~~
NEXT ASSEMBLY	QUANTITY
APPLICATION	

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ±1/16 DECIMALS .XX ±.01 .XXX ±.005 ANGLES ±1/2°
REMOVE BURRS, BREAK SHARP EDGES.
MATERIAL: 14 Ga. 304 STAINLESS STEEL
FINISH: 125 V APPROX. WEIGHT, LBS: 1
DO NOT SCALE DRAWING

CUSTOMER P.O. No.	DYNACON JOB No. ~~425~~	
APPROVALS		DATE
DRAWN	DRB	05/01/95
DRAFTING CHECK	DRB	05/01/95
ENGINEERING CHECK	CLB	04/19/95
ENGINEERING APPROVAL	JRJ	04/19/95
PRODUCTION APPROVAL	DJ	04/19/95

TRACTION WINCH SYSTEM GAUGE PANEL

SIZE	CAGE CODE	DWG NO.	REV
C	OFSDO	405-9002-04	A

SCALE 1/2 | FILE J:\405\40590204 | SHEET 1 OF 1

08/03/95 09:03

REFERENCE DIAGRAM NUMBER: 424-8001-01 APPROVED:_____

TAG NUMBER	QTY. REQ.	COMPONENT DESCRIPTION	MANUFACTURER & PART NUMBER
ACC-1	1	ACCUMULATOR- DIAPHRAGM TYPE CAPACITY: 0.32 LITERS (0.08 GALLONS) EFFECTIVE GAS VOLUME: 20 CU. IN. DESIGN PRESSURE: 3000 PSI BOTTOM CONNECTION: 3/4-16 UNF (SAE-8) WEIGHT: 2.9 lb.	HYDAC SB210-.32E4/112S- 210CK
BK-1 BK-2	2	BRAKE- CALIPER TYPE DUAL PADS ACTION: FAIL CLOSED(PRESSURE TO OPEN) HYDRAULIC CONNECTIONS: #4 SAE O-RING WEIGHT: 15 lb.	MICO 03-530-126
CYL-1	1	HYDRAULIC CYLINDER MAXIMUM TRAVEL: 4" HEAVY WALL CARBON STEEL BODY HEAT TREATED ALUMINUM ALLOY PISTON HIGH TENSILE CARBON STEEL CR.PLT. ROD OPERATING PRESSURE: 3000 PSI CLEVIS SIZE: 1/2" COMPLETE WITH CLEVIS & COTTER PINS PRESSURE CONNECTIONS: 1/4" NPT(F)	MARTNER BMC 1504
HDR-2	1	HEADER- RETURN TYPE CD1018 STEEL BODY INLET CONNECTIONS: (4) 3/8" NPT OUTLET CONNECTION: 1/2" NPT GAUGE CONNECTIONS: (2) 1/4" NPT	DYNACON 405-8003-01
HM-1	1	HYDRAULIC MOTOR- BIDIRECTIONAL TYPE (TRACTION WINCH DRIVE) DISPLACEMENT: 27.41 CU. IN./REV. MAXIMUM SPEED: 450 RPM MAX. CONTINUOUS PRESSURE: 3625 PSI TORQUE: 0.365 lb-ft/100 PSI PEAK POWER: 61.7 HP OUTPUT SHAFT: ISO 2491 PARALLEL KEYED SPECIAL MOUNTING FLANGE: (C200223336) TO 1" CODE 61 4-BOLT DRAIN PORT: 1/4" BSPP	REXROTH/CALZONI MR450P3/F

REFERENCE DIAGRAM NUMBER: 424-8001-01 APPROVED:_____

TAG NUMBER	QTY. REQ.	COMPONENT DESCRIPTION	MANUFACTURER & PART NUMBER
HM-2	1	HYDRAULIC MOTOR- BIDIRECTIONAL TYPE (LEVELWIND DRIVE) DISPLACEMENT: 5.9 CU. IN./REV. MAX. CONTINUOUS SPEED: 622 RPM DESIGN PRESSURE: 2000 PSI TORQUE: 1134 in-lb OUTPUT SHAFT: 1" SAE-A 2-BOLT FACE MOUNT PRESSURE CONNECTIONS: SAE-10 WEIGHT: 11.9 lb.	DANFOSS 151-2003-DH100
PRRV-1	1	PRESSURE REDUCING/RELIEVING VALVE ALUMINUM BODY, STD SCREW ADJUSTMENT RANGE: 50 TO 1500 PSI SEAL MATERIAL: BUNA-N DESIGN PRESSURE: 3000 PSI CONNECTIONS: 3/8" SAE O-RING	SUN PPDB-LBN-ECI
PRV-1	1	PRESSURE REDUCING VALVE ALUMINUM BODY, STD. SCREW ADJUSTMENT RANGE: 100 TO 3000 PSI SEAL MATERIAL: BUNA-N DESIGN PRESSURE: 3000 PSI CONNECTIONS: 3/8" SAE O-RING	SUN PBDB-LAN-ECI
QD-2	1	QUICK DISCONNECT COUPLING (MALE) CONNECTION SIZE: 1/2" NPT(F)	STAUBLI RBE08-7203/IA/3/HI
QD-4	1	QUICK DISCONNECT COUPLING (MALE) CONNECTION SIZE: 1/2" NPT(F)	STAUBLI RBE08-7203/IA/9/HI
QD-5	1	QUICK DISCONNECT COUPLING (MALE) CONNECTION SIZE: 1/4" NPT(F)	STAUBLI RBE06-7201/IA/6/HI
QD-6	1	QUICK DISCONNECT COUPLING (FEMALE) CONNECTION SIZE: 1/4" NPT(F)	STAUBLI RBE06-2201/OD/IA/ 6/HP/FB/DKB
QD-8	1	QUICK DISCONNECT COUPLING (MALE) CONNECTION SIZE: 1/2" NPT(F) WITH PLASTIC CAP	HANSEN LL4K26 w/PPDC-4-HK
QD-10	1	QUICK DISCONNECT COUPLING (MALE) CONNECTION SIZE: 3/4" NPT(F)	STAUBLI RBE11-7204/IA/6/HP
QD-12	1	QUICK DISCONNECT COUPLING (MALE) CONNECTION SIZE: 3/4" NPT(F)	STAUBLI RBE11-7204/IA/ 1.5/HP

REFERENCE DIAGRAM NUMBER: 424-8001-01 APPROVED: _____

TAG NUMBER	QTY. REQ.	COMPONENT DESCRIPTION	MANUFACTURER & PART NUMBER
SOV-2	1	SOLENOID OPERATED VALVE DIRECT ACTING, SPRING RETURN FLOW: 10 GPM NOMINAL DESIGN PRESSURE: 3000 PSI MAX. INTERNAL LEAKAGE: 5 CU.IN./MIN. RESPONSE TIME: 30-45 ms BUNA-N O-RING SEALS PRESSURE CONNECTIONS: 3/8" SAE O-RING 12 WATT STANDARD COIL WITH HIRSCHMANN ELECTRICAL CONNECTOR FAIL POSITION: SOLENOID VOLTAGE: WEIGHT: 4.4 oz.	DELTA DFS3A00HC12S
SVV-1	1	SERVOVALVE DESIGN PRESSURE: 3000 PSI SINGLE COIL SIGNAL: 100 mA RATED FLOW: 4.75 GPM @ 1000 PSID POSITIVE POLARITY COIL RESISTANCE: 28 OHMS NOMINAL THRESHOLD: <1% OF RATED SIGNAL HYSTERESIS: <5% OF RATED SIGNAL LEAKAGE: 2.8 CU.IN./SEC @ 3000 PSI SEAL MATERIAL: BUNA-N, 90D PRESS. CONNECTIONS: 1/2" SAE O-RING	MOOG 631-102C w/A72022-1

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
–	A	ADDED HOSE LENGTHS	10/31/95	JSH

NOTES:

1. REFERENCE LINE NUMBERS TO SQUARE CALLOUTS ON DRAWING No. 424-8001-01.
2. ALL TUBING IS SEAMLESS, TYPE 304 STAINLESS STEEL.
3. ALL HOSES ARE IDENTIFIED BY DAYCO PART NUMBERS.
4. ALL HOSES ARE DESIGNED FOR 4:1 SAFETY FACTOR.
5. ALL TUBING IS DESIGNED FOR 6:1 SAFETY FACTOR.
6. ALL PIPING IS DESIGNED FOR 6:1 SAFETY FACTOR.

424-8001-01	1
NEXT ASSY	QUANTITY

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ±1/16 DECIMALS .XX ±.02 .XXX±.005 ANGLES ±1/2°
REMOVE BURRS, BREAK SHARP EDGES.
MATERIAL

FINISH 125 | APPROX. WT, LBS

DO NOT SCALE DRAWING

CUSTOMER P.O. No. | DYNACON JOB No. 424

APPROVALS		DATE
DRAWN	PRC	07/27/95
DRAFTING CHECK	DRB	08/01/95
ENGINEERING CHECK	JED	08/03/95
ENGINEERING APPROVAL	JRJ	08/04/95
PRODUCTION APPROVAL	JRJ	08/04/95

DYNACON, INC.
831 INDUSTRIAL BLVD.
BRYAN, TEXAS USA 77803

LEVELWIND / STORAGE WINCH FLOW LINE SCHEDULE

SIZE	CAGE CODE	DWG NO.	REV
A	OFSDO	424-8009-02	A

SCALE 1/1 | FILE J:\424\42480902 | SHEET 1 OF 2

10/31/95 09:20

REFERENCE DRAWING NUMBER:424-8001-01 APPROVED: JEQ

LINE NO.	HOSE OR TUBE TYPE	PRESSURE RATING, PSIG	LENGTH INCHES
39	8BX-8FJ8SB-8FJ8SB	3500	600
40	8MX-8FJ8SB-8FJ8SB	2000	600
41	304 ST.ST. TUBING .250 x .035 WALL	3500	AS REQ'D
42	304 ST.ST. TUBING .375 x .035 WALL	2333	AS REQ'D
43	304 ST.ST. TUBING .250 x .035 WALL	3500	AS REQ'D
44	4BX-4FJ4SB-4FJ4SB	5000	216 1/2
45	304 ST.ST. TUBING .375 x .035 WALL	2333	AS REQ'D
46	304 ST.ST. TUBING .250 x .035 WALL	3500	AS REQ'D
47	304 ST.ST. TUBING .375 x .035 WALL	2333	AS REQ'D
48	6BX-6FJ6SB-6FJ6SB	4000	94 1/2
49	6BX-6FJ6SB-6FJ6SB	4000	99
50			
51	8MX-8FJ8SB-8FJ8SB	2000	600
52	12CE-12FJ12BW-12FJ12BW	4000	600
53	12CE-12FJ12BW-12FJ12BW	4000	600
59			
60			
61			
62			
63			
64			
65			
66			
67	4BX-4FJ4SB-4FJ4SB	5000	225
68	4BX-4FJ4SB-4FJ4SB	5000	222
69	4BX-4FJ4SB-4FJ4SB	5000	9 1/2
70	4BX-4FJ4SB-4FJ4SB	5000	42
71	304 ST.ST. TUBING .250 x .035 WALL	3500	AS REQ'D

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	AS BUILT	11/15/95	M Stacy

425-9001-01	1 SET
NEXT ASSY	QUANTITY
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS DECIMALS ANGLES
±1/16 XX ±.02 ±1/2°
.XXX±.005
REMOVE BURRS. BREAK SHARP EDGES.
MATERIAL

FINISH 125/ | APPROX. WT. LBS

DO NOT SCALE DRAWING

CUSTOMER P.O. No. | DYNACON JOB No. 425

APPROVALS		DATE
DRAWN	DRB	08/01/95
DRAFTING CHECK	DRB	08/01/95
ENGINEERING CHECK	MJS	08/01/95
ENGINEERING APPROVAL	MC	08/02/95
PRODUCTION APPROVAL	JRJ	08/02/95

THIS DRAWING IS THE PROPERTY OF

DYNACON, INC.
831 INDUSTRIAL BLVD.
BRYAN, TEXAS USA 77803

TRACTION WINCH ELECTRICAL COMPONENT SPECIFICATION

SIZE	CAGE CODE	DWG NO.	REV
A	OFSDO	425-9009-01	A

SCALE 1/1 | FILE J:\425\42590901 | SHEET 1 OF 4

11/15/95 15:07

REFERENCE DIAGRAM NUMBER: 425-9001-01 APPROVED: MJS

ITEM NUMBER	QTY. REQ.	COMPONENT DESCRIPTION	MANUFACTURER & PART NUMBER
1	1	ENCLOSURE WITH INTERNAL PANEL	HOFFMAN A-20H2408SSLP W/A-24P20
2	1	FUEL PRESSURE SWITCH	
3	1	FUSE BLOCK	IDEC BNF10/5A
4	1	FUSE BLOCK	IDEC BNF10/5A
5	1	FUSE BLOCK	IDEC BNF10/5A
6	1	METAL OXIDE VERMISTOR, 22V	ALLIED ELECTRONICS V39MA2A
7	1	CONNECTOR WITH LOCKING SLEEVE	SUBCONN BH12F W/DLSC-F
11	1	RELAY WITH SOCKET, K7	IDEC RH3B-UL-DC12V W/SH3B-05
12	1	RELAY WITH SOCKET, K6	IDEC RH3B-UL-DC12V W/SH3B-05
13	1	RELAY WITH SOCKET, K5	IDEC RH3B-UL-DC12V W/SH3B-05
14	1	RELAY WITH SOCKET, K4	IDEC RH3B-UL-DC12V W/SH3B-05
15	1	RELAY WITH SOCKET, K3	IDEC RH3B-UL-DC12V W/SH3B-05
20	1	DIODE	1N4004
21	1	DIODE	1N4004
22	1	CONNECTOR WITH LOCKING SLEEVE	SUBCONN BH6F W/DLSB-F
23	1	CONNECTOR WITH LOCKING SLEEVE	SUBCONN IL6M W/DLSB-M
24	1	RESISTOR, 120 OHM @ 1 WATT	
25	1	TERMINAL BLOCK	IDEC BNH15LW
26	1	CONNECTOR WITH LOCKING SLEEVE	SUBCONN BH16F W/DLSC-M
29	1	PUSHBUTTON OPERATOR	FURNAS 52PA8 W/52BAK & 52AABA
30	1	PUSHBUTTON OPERATOR	FURNAS 52PA8 W/52BAK & 52AABA

REFERENCE DIAGRAM NUMBER: 425-9001-01 APPROVED: MJS

ITEM NUMBER	QTY. REQ.	COMPONENT DESCRIPTION	MANUFACTURER & PART NUMBER
32	1	RELAY WITH SOCKET, K8	IDEC RH3B-UL-DC12V W/SH3B
33	1	RELAY WITH SOCKET, K2	IDEC RH3B-UL-DC12V W/SH3B
34	1	CONNECTOR WITH LOCKING SLEEVE	IMPULSE BMH-18FS W/DLSD-F
35	1	CONNECTOR WITH LOCKING SLEEVE	IMPULSE MIL-18MP W/DLSC-M
39	1	PROOF OF TENSION	BARKSDALE
40	1	ELECTRICAL DISPLACEMENT CONTROL	SEE 425-8009-01 TAG No HP-1
41	1	DELTA SOLENOID VALVE	SEE 425-8009-01
42	1	ELECTRICAL DISPLACEMENT CONTROL	SEE 425-8009-01 TAG No HP-2
43	1	DIODE	1N4004
45	1	ENCLOSURE WITH PANEL	CIRCLE AW 644-4XSCHC W/AW64P
100	1	ENCLOSURE WITH PANEL	CIRCLE AW 16146-4XSCHC W/AW1614P
101	1	TERMINAL BLOCK	IDEC BNH15LW
102	1	CONTROL	SUNDSTRAND MCH51AB1174
103	1	LAMP (AMBER)	DIALIGHT 125-1310-11-103 W/125-1133-403
104	1	TOGGLE SWITCH	MICRO SWITCH 2TLI-70
106	1	TOGGLE SWITCH	MICRO SWITCH 2TLI-70
107	1	METER	M/D TOTCO LM2000E533

REFERENCE DIAGRAM NUMBER: 425-9001-01 APPROVED: WS

ITEM NUMBER	QTY. REQ.	COMPONENT DESCRIPTION	MANUFACTURER & PART NUMBER
108	1	LAMP (AMBER)	DIALIGHT 125-1310-11-103 W/125-1133-403
109	1	LAMP (AMBER)	DIALIGHT 125-1310-11-103 W/125-1133-403
110	1	LAMP (RED)	DIALIGHT 125-1310-11-103 W/125-1133-403
111	1	LAMP (AMBER)	DIALIGHT 125-1310-11-103 W/125-1133-403
112	1	CONTROL	SUNDSTRAND MCH51AB1174
200	1	ENCLOSURE WITH PANEL	CIRCLE AW 14126-4XSCHC W/AW1412P
204	1	LAMP (AMBER)	DIALIGHT 125-1310-11-103 W/125-1133-403
205	1	LAMP (AMBER)	DIALIGHT 125-1310-11-103 W/125-1133-403
206	1	LAMP (AMBER)	DIALIGHT 125-1310-11-103 W/125-1133-403
207	1	METER	M/D TOTCO LM2000E533
209	1	CONTROL	SUNDSTRAND MCH51AB1174
210	1	TERMINAL BLOCK	IDEC BNH15LW
211	1	CONNECTOR WITH LOCKING SLEEVE	SUBCONN IL16M W/DLSC-M

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	AS BUILT	11/10/95	

13.5 V BATTERY

12V BATTERY RETURN

TB3-1
TB3-2
TB3-3
TB3-4
TB3-5
TB3-6
TB3-7

O LEVELWIND UNIT
#G. 424-9001-01

TB3-8
TB3-9

DIESEL START

TB1

TB5

+13.5VDC

FUEL PRESSURE SWITCH

TO STARTER SOLENOID

OIL PRESSURE SWITCH

PROOF OF PRESSURE

ELECTRIC DISPLACEMENT CONTROL STORAGE WINCH

TRACTION WINCH BRAKE RELEASE VALVE

ELECTRIC DISPLACEMENT CONTROL TRACTION WINCH

R3 120 Ω

K1 NOT USED
K2 A
K3 A,B
K4 A,B
K5 A,B,C
K6 A,B,C
K7 A,B,C
K8 A,B,C

J1 J2 J3 J4 P1 P2 P3

TB2 TB4

REMOTE ENABLE

DIESEL OIL PRESSURE WARNING

LINE DATA

STORAGE WINCH

PROOF OF TENSION

AUTOMATIC ENABLED

REMOTE ENABLED

TRACTION WINCH BRAKE RELEASED

LOCAL CONTROL

TRACTION WINCH

REMOTE CONTROL

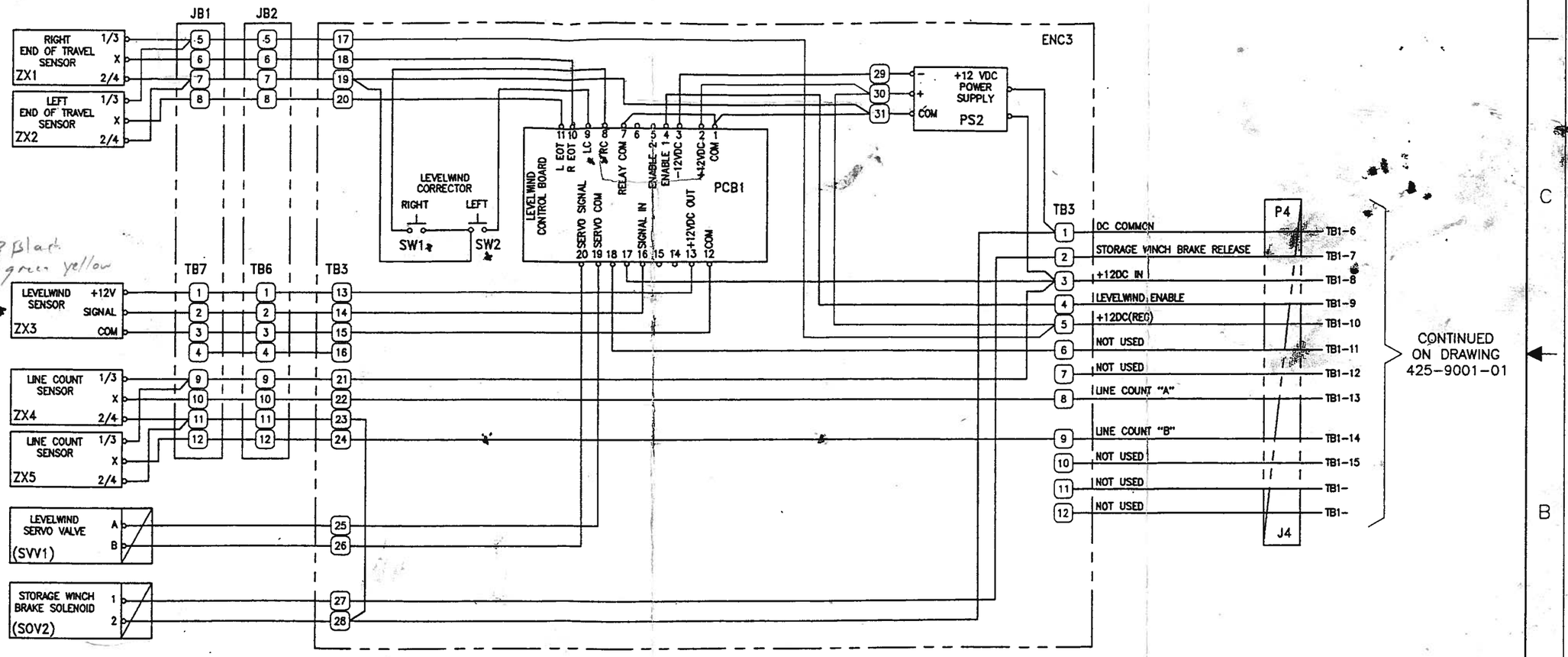
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ARE:		
FRACTIONS ±	DECIMALS .XX ± .XXX ±	ANGLES ±
REMOVE BURRS, BREAK SHARP EDGES.		
MATERIAL 425-9009-01		
FINISH	APPROX. WEIGHT, LBS	

CUSTOMER P.O. No.	DYNACON JOB No. 425	
APPROVALS		DATE
DRAWN	DRB	08/15/95
DRAFTING CHECK	DRB	08/21/95
ENGINEERING CHECK	MC	08/21/95
ENGINEERING	JRL	08/21/95

TRACTION WINCH SYSTEM ELECTRICAL SCHEMATIC DIAGRAM

SIZE	CAGE CODE	DWG NO.	REV

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	AS BUILT	11/10/95	MJS



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ± REMOVE BURRS, BREAK SHARP EDGES.	CUSTOMER P.O. No.	DYNACON JOB No. 424	THIS DRAWING IS THE PROPERTY OF DYNACON, INC. 831 INDUSTRIAL BLVD. BRYAN, TEXAS USA 77803 ANY REPRODUCTION OR USE OF THIS DESIGN IS EXPRESSLY FORBIDDEN UNLESS AUTHORIZED IN WRITING.
MATERIAL 424-9009-01 (424-8009-01)	APPROVALS	DATE	LEVELWIND ELECTRICAL SYSTEM SCHEMATIC DIAGRAM
FINISH ✓ APPROX. WEIGHT, LBS	DRAWN DRB	08/14/95	SIZE C CAGE CODE OFSDO DWG NO. 424-9001-01 REV a
DO NOT SCALE DRAWING	DRAFTING CHECK DRB	08/21/95	SCALE (1=1) FILE J:\424\42490101 SHEET 1 OF 1
	ENGINEERING CHECK MC	08/21/95	
	ENGINEERING APPROVAL JRJ	08/21/95	
	PRODUCTION APPROVAL MJS	08/21/95	

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
–	A	PER DCN DATED 10/30/95	10/31/95	930

TRACTION WINCH

MGB-1 GEARBOX 142.3:1 BRAKE

MGB-2 GEARBOX 142.3:1 BRAKE

TW CASE DRAIN

TW BRAKE

TW A

TW B

DRIVE PLATE & ADAPTER

DP-1

PA-1

HP-1 TRACTION WINCH PUMP

HP-3 LEVELWIND PUMP

DIESEL MOTOR DM-1

STORAGE WINCH PUMP HP-2

PUMP DRIVE CONFIGURATION

CONTINUED ON DWG. 424-8001-01

QD-20 QD-19 QD-18 QD-17 QD-16 QD-15 QD-14 QD-13 QD-11 QD-9 QD-7 QD-3 QD-1

0-7500 PSI PG-2

0-7500 PSI PG-3

LFV-1

FCV-1

SOV-1

SET @ 4500 PSI

SET @ 2250 PSI

0-600 PSI PG-1

SET @ 360 PSI

TRACTION WINCH PUMP HP-1

50 PSI MAX. BACK PRESSURE

STORAGE WINCH PROOF OF TENSION PRESSURE SWITCH

PSH-1

PG-5 0-5000 PSI

PG-6 0-5000 PSI

LFV-2

SET @ 2200 PSI

SET @ 2000 PSI

PG-4 0-600 PSI

SET @ 360 PSI

STORAGE WINCH PUMP HP-2

RETURN HEADER HDR-1

SW CASE DRAIN

SW B

LEVELWIND RETURN

LEVELWIND PRESSURE

HYDRAULIC POWER UNIT
200 HP DIESEL

PG-7 0-3000 PSI

FL-2

HP-3 LEVELWIND PUMP SET @ 2000 PSI MAX.

HX-1

0-60 PSI PG-8

FL-1

FB-1

CC-1

LG-1

STR-1

STR-2

STR-3

TANK CAPACITY = 118 gal.

BV-1

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ARE:			
FRACTIONS	DECIMALS	ANGLES	
± 1/16	.XX ± .02	± 1/2°	
	.XXX ± .005		
REMOVE BURRS, BREAK SHARP EDGES.			
MATERIAL	425-8009-01 425-8009-02		
FINISH 125	APPROX. WEIGHT, LBS		
DO NOT SCALE DRAWING			

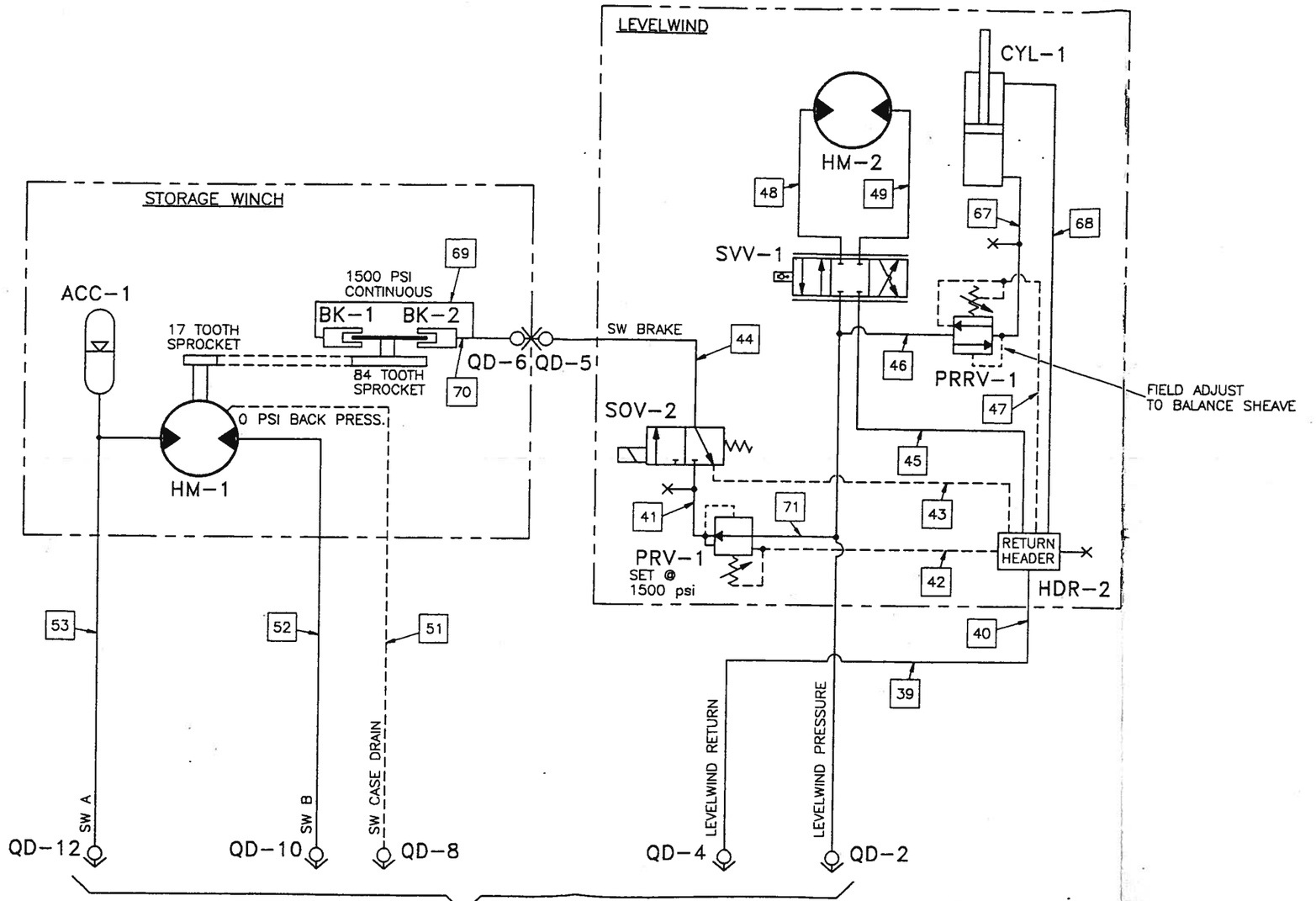
CUSTOMER P.O. No.	DYNACON JOB No. 425	
APPROVALS		DATE
DRAWN	PRC	07/27/95
DRAFTING CHECK	DRB	08/02/95
ENGINEERING CHECK	JED	08/03/95
ENGINEERING APPROVAL	JRJ	08/04/95
PRODUCTION APPROVAL	JRJ	08/04/95

TRACTION WINCH SYSTEM HYDRAULIC SCHEMATIC

SIZE	CAGE CODE	DWG NO.	REV
D	OFSDO	425-8001-01	A
SCALE 1/1	PATH J:\425\42580101		SHEET 1 OF 1

10/31/95 09:50

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
–	A	PER DCN DATED 10/30/95	10/31/95	



CONTINUED ON DWG. 425-8001-01

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ±1/16 DECIMALS .XX ±.02 .XXX ±.005 ANGLES ±1/2°
REMOVE BURRS, BREAK SHARP EDGES.
MATERIAL 424-8009-01 424-8009-02
FINISH 125 APPROX. WEIGHT, LBS
DO NOT SCALE DRAWING

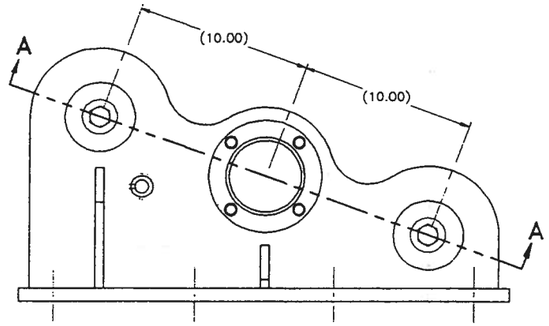
CUSTOMER P.O. No.	DYNACON JOB No. 424
APPROVALS	DATE
DRAWN PRC	07/27/95
DRAFTING CHECK DRB	08/03/95
ENGINEERING CHECK JED	08/03/95
ENGINEERING APPROVAL JRJ	08/04/95
MANUFACTURING APPROVAL JRJ	08/04/95

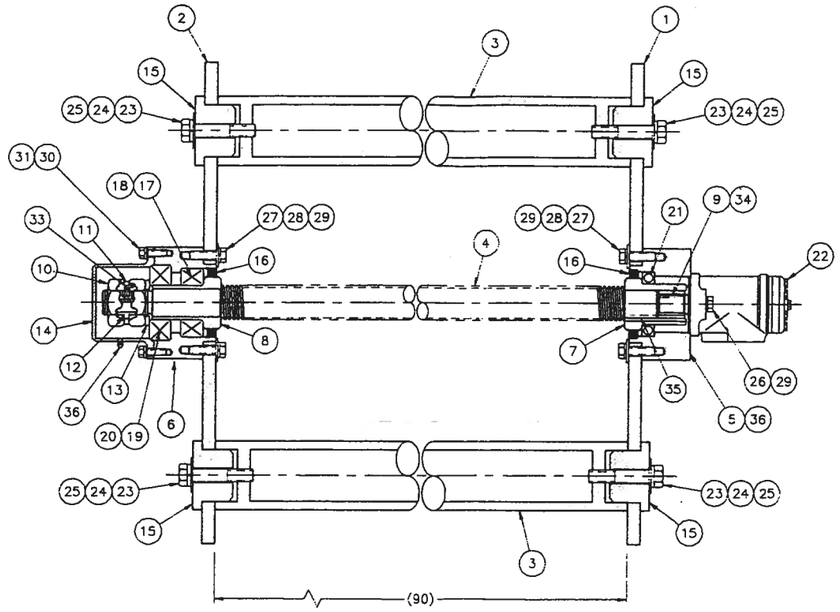
LEVELWIND / STORAGE WINCH HYDRAULIC SCHEMATIC

SIZE	CAGE CODE	DWG NO.	REV
C	OFSDO	424-8001-01	A

SCALE 1/1 FILE J:\424\42480101 SHEET 1 OF 1

10/31/95 09:36





SECTION A–A
SCALE: 1/4

QTY REQD	PART NUMBER	DESCRIPTION	MATERIAL SPECIFICATION	ITEM NO.
4		LOCK WASHER ø3/8 HELICAL SPRING	STAINLESS STEEL	32
4		FLAT WASHER ø3/8 SAE	STAINLESS STEEL	31
4		HEX HEAD CAP SCREW 3/8–16 UNC x 1 1/4 LG	STAINLESS STEEL	30
10		LOCK WASHER ø1/2 HELICAL SPRING	STAINLESS STEEL	29
8		FLAT WASHER ø1/2 SAE	STAINLESS STEEL	28
8		HEX HEAD SCREW 1/2–13 UNC x 1 3/4	STAINLESS STEEL	27
2		HEX HEAD SCREW 1/2–13 UNC x 2	STAINLESS STEEL	26
4		LOCK WASHER ø3/4 HELICAL SPRING	STAINLESS STEEL	25
4		FLAT WASHER ø3/4 SAE	STAINLESS STEEL	24
4		HEX HEAD SCREW 3/4–10 UNC x 3 3/4 LG	ZINC COATED Gr. 5 CARBON STEEL	23
1	DH–100	HYDRAULIC MOTOR (SEE DWG. 414–8009–01, TAG HM–4)	DANFOSS	22
1	6012	BALL BEARING	SKF	21
1	55200C	BEARING CONE	TIMKEN	20
1	55437	BEARING CUP	TIMKEN	19
1	49585	BEARING CONE	TIMKEN	18
1	49520	BEARING CUP	TIMKEN	17
2	9045 LUP	SEAL	J–M	16
4	DYN–2007–08	MOUNT PLUG		15
1	DYN–2005–94	BEARING CAP		14
1	DYN–2005–93	WASHER		13
1	DYN–2005–92	LOCKING KEY		12
1	DYN–2005–91	LOCKING WASHER		11
2	DYN–2005–90	JAMB NUT		10
1	DYN–2005–62	MOTOR ADAPTER		9
1	DYN–2005–52	BEARING SLEEVE		8
1	DYN–2005–42	MOTOR MOUNT SLEEVE		7
1	DYN–2005–33	BEARING MOUNT		6
1	DYN–2005–22	MOTOR MOUNT		5
1	414–2005–14	ACME SCREW		4
2	414–2007–05	GUIDE BAR		3
1	414–2005–12	BEARING END BRACKET		2
1	414–2005–11	MOTOR END BRACKET		1

PARTS LIST

QTY REQD	PART NUMBER	DESCRIPTION	MATERIAL SPECIFICATION	ITEM NO.
2		GREASE ZERK 1/4–28 UNF	STAINLESS STEEL	36
1		KEY 3/8 SQ. x 3 1/4 LG	STAINLESS STEEL	35
1		KEY 1/4 SQ. x 1 LG	STAINLESS STEEL	34
1		ROLL PIN ø3/16 x 1/2 LG	STAINLESS STEEL	33

PARTS LIST

NEXT ASSEMBLY	QUANTITY
405–2001–02	1
APPLICATION	

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ARE:
FRACTIONS ± 1/16 DECIMALS .XX ± .02 .XXX ± .005 ANGLES ± 1/2°
REMOVE BURRS. BREAK SHARP EDGES.
MATERIAL SEE PARTS LIST
FINISH 125 √ APPROX. WEIGHT, LBS 600
DO NOT SCALE DRAWING

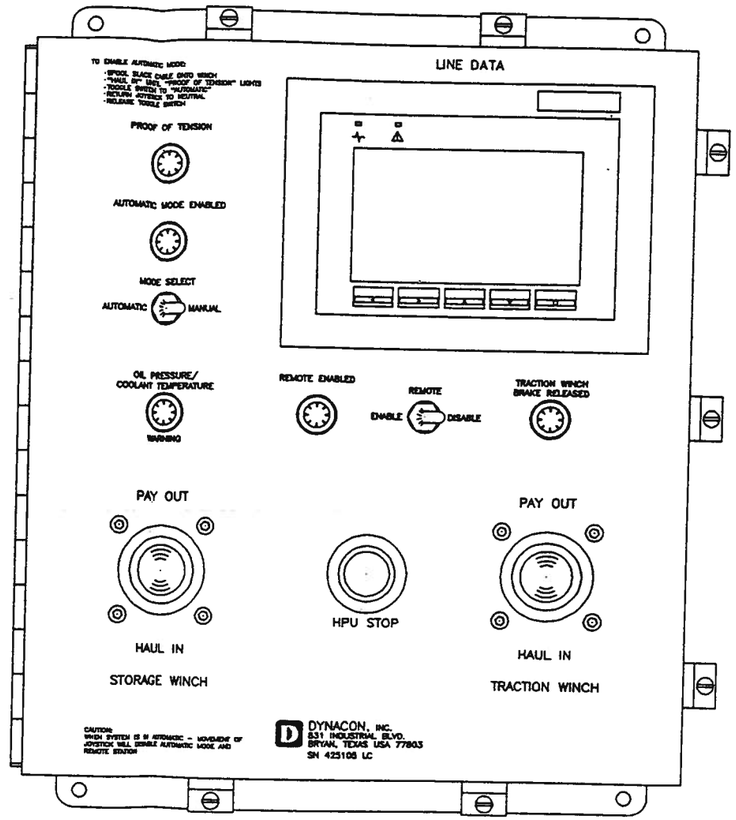
CUSTOMER P.O. No. | DYNACON JOB No. 424

APPROVALS		DATE
DRAWN	ALN	07/17/95
DRAFTING CHECK	DRB	7/18/95
ENGINEERING CHECK	[illegible]	7/19/95
ENGINEERING APPROVAL	[illegible]	7/19/95
PRODUCTION APPROVAL	[illegible]	7/19/95

LEVELWIND DRIVE ASSEMBLY

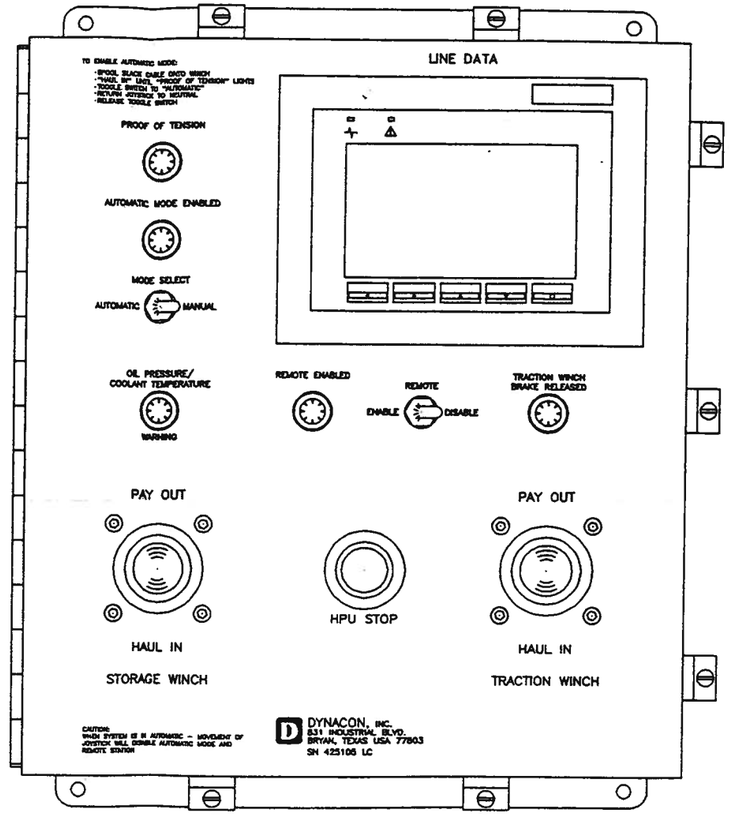
SIZE D | CAGE CODE OFSDO | DWG NO. 424–2005–02 | REV –
SCALE 1/4 | PATH J:\424\42420502 | SHEET 1 OF 1
07/17/95 16:48

REPLACES 414-2005-02



		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ±1/16, DECIMALS .XX ±.02, .XXX ±.005, ANGLES ±1/2°. REMOVE BURRS, BREAK SHARP EDGES.	CUSTOMER P.O. No.	DYNACON JOB No. 425	THIS DRAWING IS THE PROPERTY OF DYNACON, INC. 831 INDUSTRIAL BLVD. BRYAN, TEXAS USA 77803	ANY REPRODUCTION OR USE OF THIS DESIGN IS EXPRESSLY FORBIDDEN UNLESS AUTHORIZED IN WRITING.
		MATERIAL 425-9002-04	APPROVALS	DATE	LOCAL CONTROL ENCLOSURE	
425-9009-01	1	FINISH 125	DRAWN ALN	08/15/95		
NEXT ASSEMBLY	QUANTITY	APPROX. WEIGHT, LBS	DRAFTING CHECK DRB	8/15/95	SIZE C	CAGE CODE OFSDO
APPLICATION		DO NOT SCALE DRAWING	ENGINEERING CHECK DAL	8-21-95	DWG NO. 425-9002-01	REV —
			ENGINEERING APPROVAL	8/21/95	SCALE 1/2	FILE J:\425\42590201
			PRODUCTION APPROVAL	8-17-95		SHEET 1 OF 1

08/15/95 11:22



		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ±1/16 DECIMALS .XX ±.02 .XXX ±.005 ANGLES ±1/2° REMOVE BURRS, BREAK SHARP EDGES.	CUSTOMER P.O. No.	DYNACON JOB No. 425	THIS DRAWING IS THE PROPERTY OF DYNACON, INC. 831 INDUSTRIAL BLVD. BRYAN, TEXAS USA 77803	ANY REPRODUCTION OR USE OF THIS DESIGN IS EXPRESSLY FORBIDDEN UNLESS AUTHORIZED IN WRITING.
			APPROVALS	DATE		
		MATERIAL 425-9002-04	DRAWN ALN	08/15/95	LOCAL CONTROL ENCLOSURE	
			DRAFTING CHECK DRB	8/15/95		
425-9009-01	1	FINISH 125	ENGINEERING CHECK DAL	8-21-95	SIZE C	CAGE CODE OFSDO
NEXT ASSEMBLY	QUANTITY	APPROX. WEIGHT, LBS	ENGINEERING APPROVAL	8/21/95	DWG NO. 425-9002-01	REV –
APPLICATION		DO NOT SCALE DRAWING	PRODUCTION APPROVAL	8-17-95	SCALE 1/2	SHEET 1 OF 1
					FILE J:\425\42590201	

08/15/95 11:22

Section 11

Section 11 - QUICK REFERENCE DATA

11.1 System Ratings

11.1.1 Traction Winch

11.1.1.1 Maximum Continuous Line Pull ..... 18,000 pounds

11.1.1.2 Line Speed ..... 140 feet per minute

11.1.2 Storage Winch

11.1.2.1 Maximum Line Pull ..... 2,500 pounds

11.1.2.2 Line Speed ..... 377 feet per minute

11.1.2.3 Capacity ..... 36,000 feet of 0.680 inch diameter cable

11.2 System Component Weights and Dimensions

11.2.1 Traction Winch

11.2.1.1 Weight ..... 10,500 lbs

11.2.1.2 Dimensions ..... 133" (L)
60" (W)
72" (H)

11.2.2 Levelwind

11.2.2.1 Weight ..... 2,200 lbs

11.2.2.2 Dimensions ..... 105 5/16" (L)
56 1/4" (W)
42" (H)

11.2.3 Storage Winch

11.2.3.1 Weight - Bare Drum ..... 8,200 lbs

11.2.3.2 Dimensions ..... 98" (L)
86" (W)
82" (H)

11.2.4 Diesel Hydraulic Power Unit

11.2.4.1 Weight-(with hydraulic oil, without panel and covers) . . . . . 7,200 lbs

11.2.4.2 Dimensions . . . . . 132" (L)
48" (W)
82 1/2 " (H)

Section 12

Section 12 - COMPONENT SUPPORT LITERATURE

12.1 Overview

Support literature is provided for system components to include manufacturers' bulletins, catalogues, ordering/maintenance procedures, parts lists and service instructions.

Reference labels are attached to component literature and provide a drawing reference number and item number corresponding to that shown on the hydraulic/electrical schematic. Reference labels also include a part description, part number, manufacturer name, address and telephone number.

HYDRAULIC COMPONENT

REFERENCE DWG # 425-8001-01/8009-01

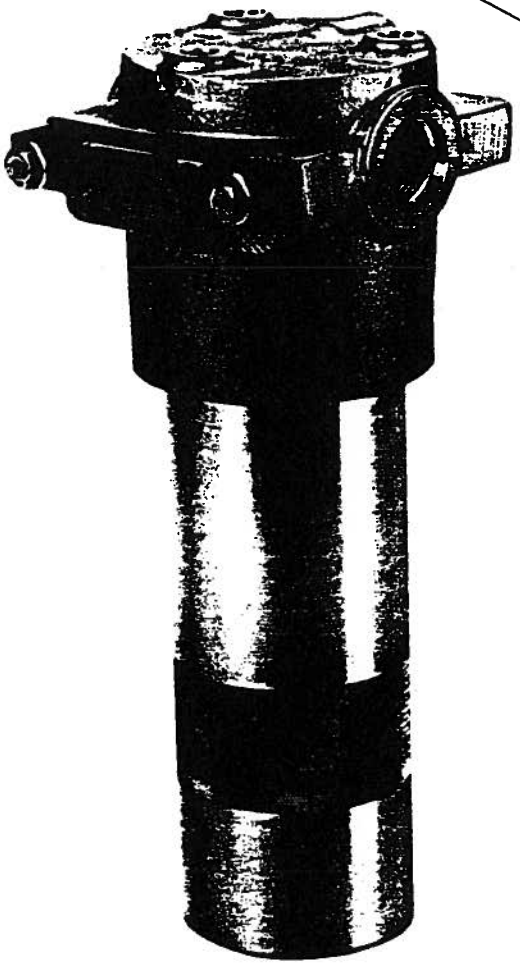
ITEM # FL-2

MANUFACTURER: DONALDSON, PO BOX 1299 MINNEAPOLIS, MN 55440 800-374-1374

DESCRIPTION: FILTER - INLINE TYPE, NO BYPASS

PART NUMBER: HPK02K00N0807X

Donaldson® Brand Hydraulic Products



Features

Working Pressures up to:
2000 PSI/13790 kPa/137.9 bar

Minimum Burst (Rated Static) Pressure up to
4500 PSI/31030 kPa/310.3 bar

Flow: Up to 20 gpm (75 lmin)

T-Type Porting
Port Size: 3/4" SAE O-Ring

Bypass Rating:
50 PSID/345 kPa/3.5 bar

Visual Indicators Tamper Resistant

Cast Aluminum Head, Impact Extruded Aluminum Bowl

Operating Temperatures
-20° F to 250° F
-29° C to 121° C

Service elements
- available in full range of SYNTEQ^{R} (synthetic) media - performance down to 3 micron absolute
- 150 psid/1034 kPa minimum collapse
- 2000 psid/13790 kPa on NO BYPASS model(s)
- Viton & BunaN elements available

Application

In-Plant or Mobile Equipment Applications

High Pressure Circuits

Servo-Valves

Power Steering Circuits

ORDER INFORMATION

Stock Assemblies

Assembly Information					Service Element Information		
Port Size	Bypass Rating	Indication	Beta(x) = 2/20/75 Rating	HPK02 Assembly Model	Media Number	Element Length	Service Element
3/4" SAE O-Ring	50 PSID 345 kPa	Visual Left Side	2μ/3μ/5μ	K020007	No. 2	4.37 Inches 111.0 mm	P165041
3/4" SAE O-Ring	50 PSID 345 kPa	Visual Left Side	2μ/3μ/5μ	K020006		8.00 Inches 203.2 mm	P165043
3/4" SAE O-Ring	No Bypass	Visual Left Side	+μ/+μ/3μ	K020009	No. 1	8.12 Inches 206.2 mm	P167182**

** High Collapse Elements

+ - Particles Less Than 2μ

Stock Service Elements

Media Number	Media Type	B(x) = 2/20/75 Rating	Element Length	Element Mm	Part Number
No. 1	Synthetic	+μ/+μ/3μ	4.37	111.0	P169429
			8.00	203.2	P167838
			8.18	206.2	P167182**
No. 2	Synthetic	2μ/3μ/5μ	4.37	111.0	P165041
			8.00	203.2	P165043
No. 4	Synthetic	4μ/10μ/13μ	4.37	111.0	P165006
			8.00	203.2	P165015
No. 7	Synthetic	7μ/17μ/22μ	4.37	111.0	P165136
			8.00	203.2	P165138

** High Collapse Elements

+ - Particles Less Than 2μ

Non-Stock Product Options

Contact Donaldson Company or your local Donaldson distributor for build-to-order non-stock product option availability and manufacturer's lead time requirements. Note--not all option combinations can be made.

Bulletin # 1200-451 (11/92)

For More Information, Contact:

Donaldson Company, Inc.
Hydraulic Products
P. O. Box 1299
Minneapolis, MN 55440
(800) 874-1874
FAX: (612) 887-3716

HYDRAULIC COMPONENT

REFERENCE DWG # 425-8001-01/8009-01

ITEM # BV-5

MANUFACTURER: NIBCO 700 E. BEARDSLEY SUITE 1B ELKHART, IN 46514-3365 800-234-0227

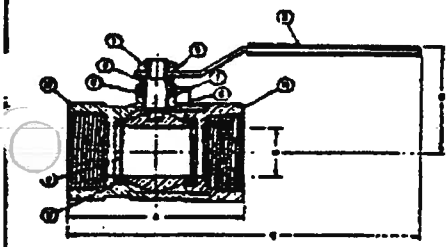
DESCRIPTION: BALL VALVE

PART NUMBER: 580-70

Federal Specification: WW-V-35B, Type II, Class A, Style 3

MATERIAL LIST

PART	SPECIFICATION
1. Handle Nut	Zinc Plated Steel
2. Handle	Zinc Plated Steel, Clear Chromate, Plastisol Coated
3. Packing Nut	Brass ASTM B-16 Alloy 360
4. Packing	TFE
5. Stem	Silicon Bronze ASTM B-371 Alloy 694
6. Thrust Washer	Reinforced TFE
7. Ball	Cast Red Bronze, ASTM B-584 Alloy 844 With Hard Chrome Plate
8. Seat Ring (2)	Reinforced TFE
9. Body	Cast Red Bronze ASTM B-584 Alloy 844 or Forging Brass ASTM B-124 Alloy 377
10. Body End Piece	Cast Red Bronze ASTM B-584 Alloy 844 or Forging Brass ASTM B-124 Alloy 377

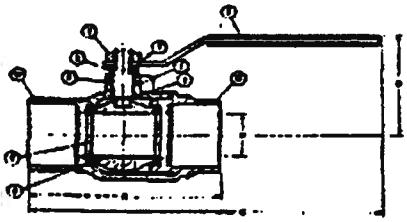


T-580-70 NPT x NPT

T-580-70
Threaded
Reinforced TFE
Seats & TFE Seals

DIMENSIONS — WEIGHTS — QUANTITIES

Size	Dim. A T-580-70	Dim. A S-580-70	Dim. B	Dim. C T-580-70	Dim. C S-580-70	Dim. D Port	Approx. Net Wt. T-580-70	Approx. Net Wt. S-580-70	Box Qty.	Master Ctn. Qty.
1	3	4	2	6	6	1	2.2	2.0	5	20
1½	4	4½	3	8	9	1¼	3.4	3.0	5	10
2	4¾	5½	3¼	9¼	9½	1½	5.0	4.4	5	6
2½	5	7	3	9½	10½	2	8.9	9.5	2	6
3	7	6	4	11	12½	2½	14.8	15.9	1	4



†S-580-70 Copper x Copper

†S-580-70
Solder
Reinforced TFE
Seats & TFE Seals

†Designed to be soft soldered into lines using solders with the melting point not exceeding 500°F. Higher temperature solders will damage the seat material.

Also available with stainless steel ball & stem.

HYDRAULIC COMPONENT

REFERENCE DWG # 425-8001-01/8009-01

ITEM # FB-1

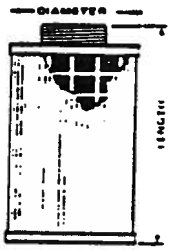
313-665-8777 FLOW EZY PO Box 1749
MANUFACTURER: ANN ARBOR, MI 48106

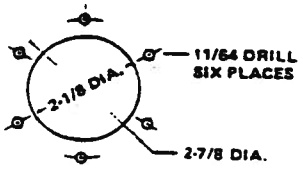
DESCRIPTION: FILLER/BREATHER

PART NUMBER: AB-1010-3

NIPPLE STYLE

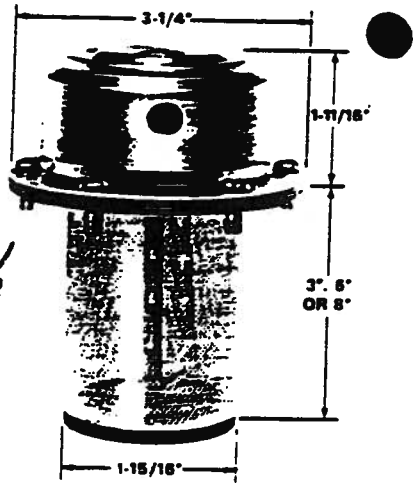
GPM RATING	SCREEN AREA (Sq. inches)	NPT (Pipe Size)	OVERALL DIMENSIONS Diameter	Length
75	400	2-1/2	5-1/16	12-5/8
100	500	3	5-1/16	12-5/8





FILLER/BREATHERS
with 30-mesh strainer baskets

Basket Depth	Filter, Micron	Model No.
3"	10	* AB-1010-3



(weatherproof caps also available)

HYDRAULIC COMPONENT

REFERENCE DWG # 425-8001-01/8009-01

ITEM # FCV-1

MANUFACTURER: REGO 100 REGO DRIVE ELON COLLEGE, NC 27244 919-449-7707

DESCRIPTION: FLOW CONTROL VALVE

PART NUMBER: MF250B

Ordering Information:

Part Number	Body Material	Check Style	P (NPT) Female	D (Inch) Hex	G (Inch)	L (Inch)	E (Inch) Male	Orifice Diameter (Inch)	CV (Free Flow Direction)	CV (Controlled Flow Direction)	Cracking Pressure (PSIG)
MF125B	Brass	Piston	1/8	11/16	9/32	1 3/4	1 1/4	.156	.32	.23	10
MF250B			1/4	7/8	5/16	2 3/8			.70	.44	7
MF375B			3/8	1 1/16	11/32	2 3/4	1 3/8	.265	1.14	.90	8
MF500B			1/2	1 5/16	3/8	3 3/16		.281	1.74	1.32	5
MF750B			3/4	1 5/8	15/32	3 9/16	1 7/8	.343	2.91	2.02	2
MF125BBC	Brass	Ball	1/8	11/16	9/32	1 3/4	1 1/4	.156	.32	.23	11
MF250BBC			1/4	7/8	5/16	2 3/8			.70	.44	7
MF375BBC			3/8	1 1/16	11/32	2 3/4	1 3/8	.265	1.14	.90	3
MF500BBC			1/2	1 5/16	3/8	3 3/16		.281	1.74	1.32	1
MF250SBC	Steel	Ball	1/4	7/8	5/16	2 3/8	1 1/4	.156	.70	.44	7
MF375SBC			3/8	1 1/16	11/32	2 3/4	1 3/8	.265	1.14	.90	3
MF500SBC			1/2	1 5/16	3/8	3 3/16		.281	1.74	1.32	1
MF750SBC			3/4	1 5/8	15/32	3 9/16	1 7/8	.343	2.91	2.02	3
MF1000SBC			1	1 7/8							

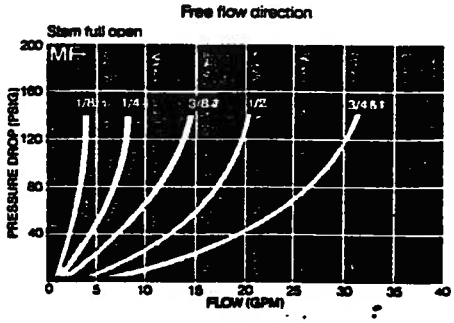
Specifications:

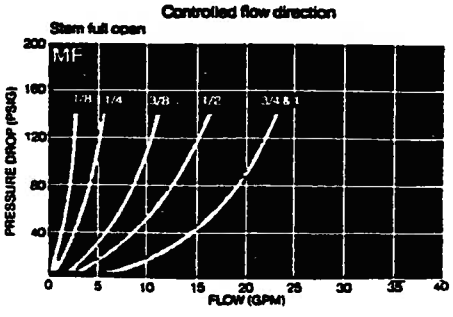
Maximum Operating Pressure	
Ball Check Models	5000 PSIG Steel 2000 PSIG Brass
Piston Check Models	2000 PSIG Brass
Temperature	−20°F to +212°F
Stem Pitch	8°
Stem Pitch	40 Threads/Inch (⅛, ¼, ⅜, ½" Sizes) 24 Threads/Inch (¾" Size)
CV Factor	See Ordering Information

Materials:

Body	12L14 Steel or ASTM B16 Brass
Piston Assembly	Stainless Steel with Viton O-ring
Spring	Stainless Steel
Stem	Stainless Steel or Brass
Knob	Brass
Check Plug	Steel or Brass
Chamber	Steel
Set Screw	Steel
Stem Packing	Viton O-ring with "Teflon" Backup

Performance





HYDRAULIC COMPONENT

REFERENCE DWG # 425-8001-01/8009-01

ITEM # FL-1

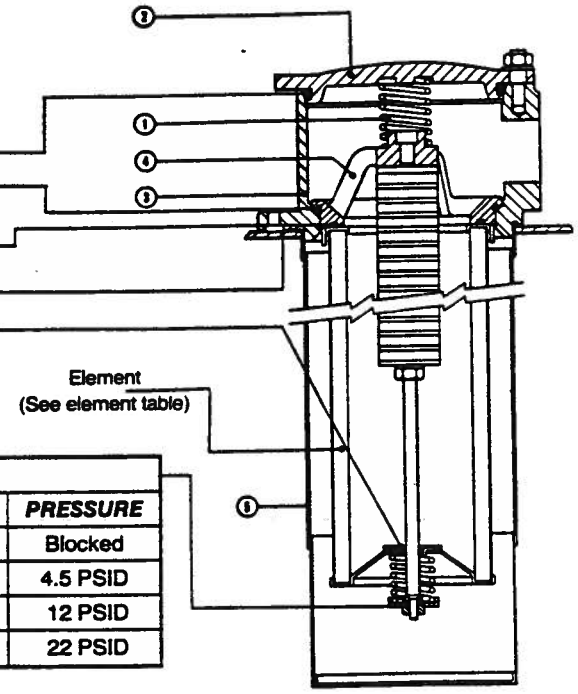
MANUFACTURER: FAIREY-ARLON 2920 94TH ST. STURTEVANT, 414-886-0888 531

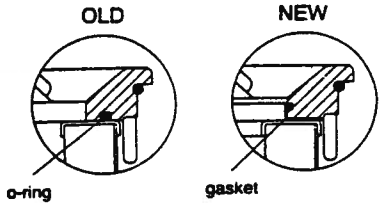
DESCRIPTION: FILTER - RETURN FLOW TY

PART NUMBER: TTF-230-SAE24-TX5-10-B-T-22-G

SEALS			
PART NUMBERS		DESCRIPTION	
TTF-60, 90 or 120	TTF-170, 230 or 300		
R-4362	R-4512	Cover O-Ring	
SOR-64	SOR-71	Insert O-Ring	
SOR-61	SOR-68	Old (o-ring)	Bypass Seal (See Detail A)
31415021	31415022	New (gasket)	
106 x 95 x 6	152 x 136 x 6	Tank Gasket	
SOR-4	SOR-113	Element O-Ring	
Buna N, Viton A or EPR		Material*	

*Please specify seal material when ordering.





Detail A

Bypass Seal Design

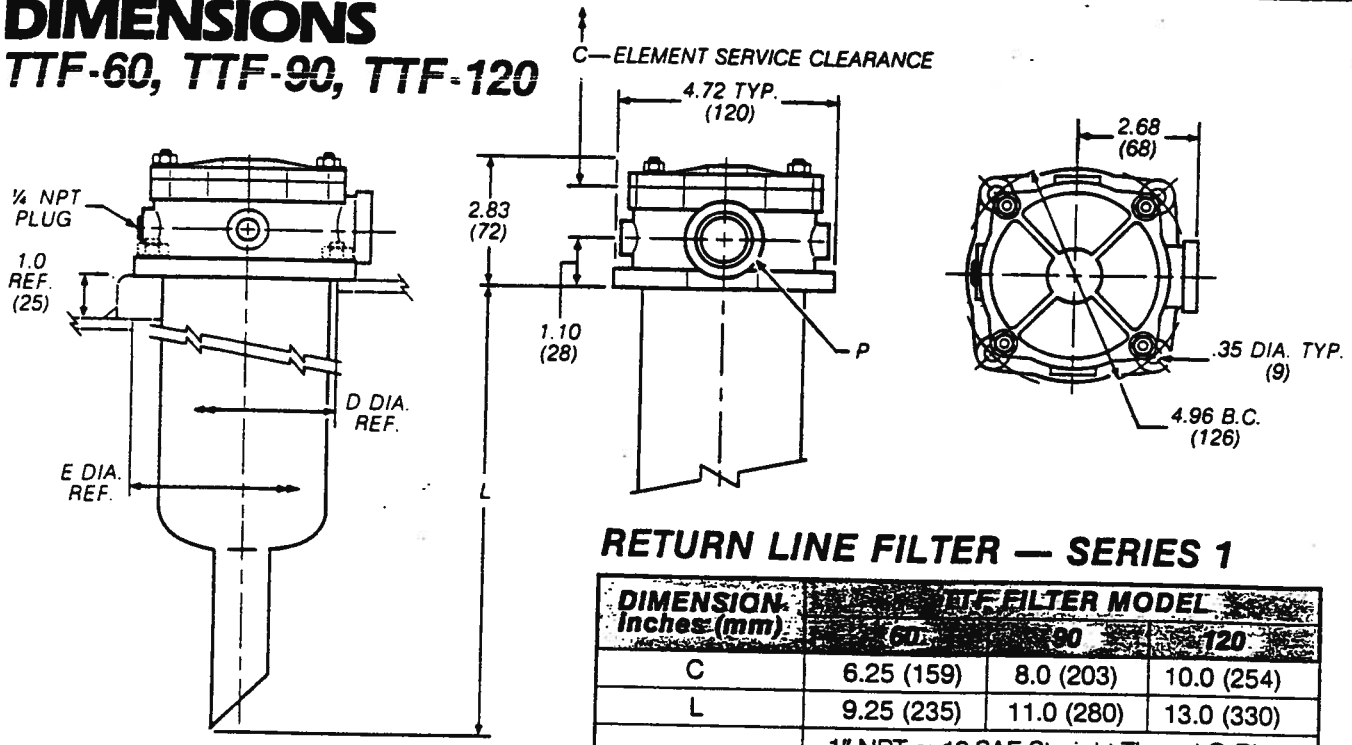
BYPASS ASSEMBLY		
60, 90 or 120	170, 230 or 300	PRESSURE
6903181	6903182	Blocked
4903017	4903018	4.5 PSID
4903001	4903002	12 PSID
4903005	4903006	22 PSID

ITEM	DESCRIPTION	MATERIAL	PART NUMBERS					
			TTF-60	TTF-90	TTF-120	TTF-170	TTF-230	TTF-300
1	Top Spring	Steel	48371201			48371205		
2	Cover	Die Cast Aluminum	5842209			5842210		
3	Head	Die Cast Aluminum	5841216/SAE16	5841248/1" NPT		5841224/SAE-24	5841264/1½" NPT	
4	Insert Assy.	Bridge - Aluminum, Shaft - Steel, Magnets - Ceramic	11020000	11030000	11040000	12050000	12060000	12070000
5	Diffusor	Steel	2107002	2107003	2107004	2107005		2107006

	ELEMENT CODES						
	DISPOSABLE					RECLEANABLE	
	MB SERIES	TX SERIES	BETAMAZE ELEMENTS			ST SERIES*	
MODEL	HIGH EFFICIENCY 10 MICRON $BETA_{10} \geq 2.5$	10 MICRON NOMINAL $BETA_{10} \geq 1.2$	3 MICRON ABSOLUTE $BETA_3 \geq 75$	10 MICRON ABSOLUTE $BETA_{10} \geq 75$	25 MICRON ABSOLUTE $BETA_{25} \geq 75$	STAINLESS STEEL MESH ELEMENTS	
TTF-60	MB2	TX2-10	TXW2-CC3	TXW2-CC10	TXW2-CC25	ST2-	10
TTF-90	MB3	TX3-10	TXW3-CC3	TXW3-CC10	TXW3-CC25	ST3-	25
TTF-120	MB3D	TX3D-10	TXW3D-CC3	TXW3D-CC10	TXW3D-CC25	ST3D-	40
TTF-170	MB4	TXX4-10	TXW4-CC3	TXW4-CC10	TXW4-CC25	ST4-	60
TTF-230	MB5	TXX5-10	TXW5-CC3	TXW5-CC10	TXW5-CC25	ST5-	120 (Micron Absolute)
TTF-300	MB5A	TXX5A-10	TXW5A-CC3	TXW5A-CC10	TXW5A-CC25	ST5A-	
Material*	Cellulose Fiber, Plastisol End Cap Adhesive	Cellulose Fiber, Epoxy End Cap Adhesive	Glass Micro-fiber, Epoxy End Cap Adhesive			Stainless Steel Mesh, Epoxy End Cap Adhesive	

*All End Caps and Support Tubes are Plated Carbon Steel

DIMENSIONS
TTF-60, TTF-90, TTF-120

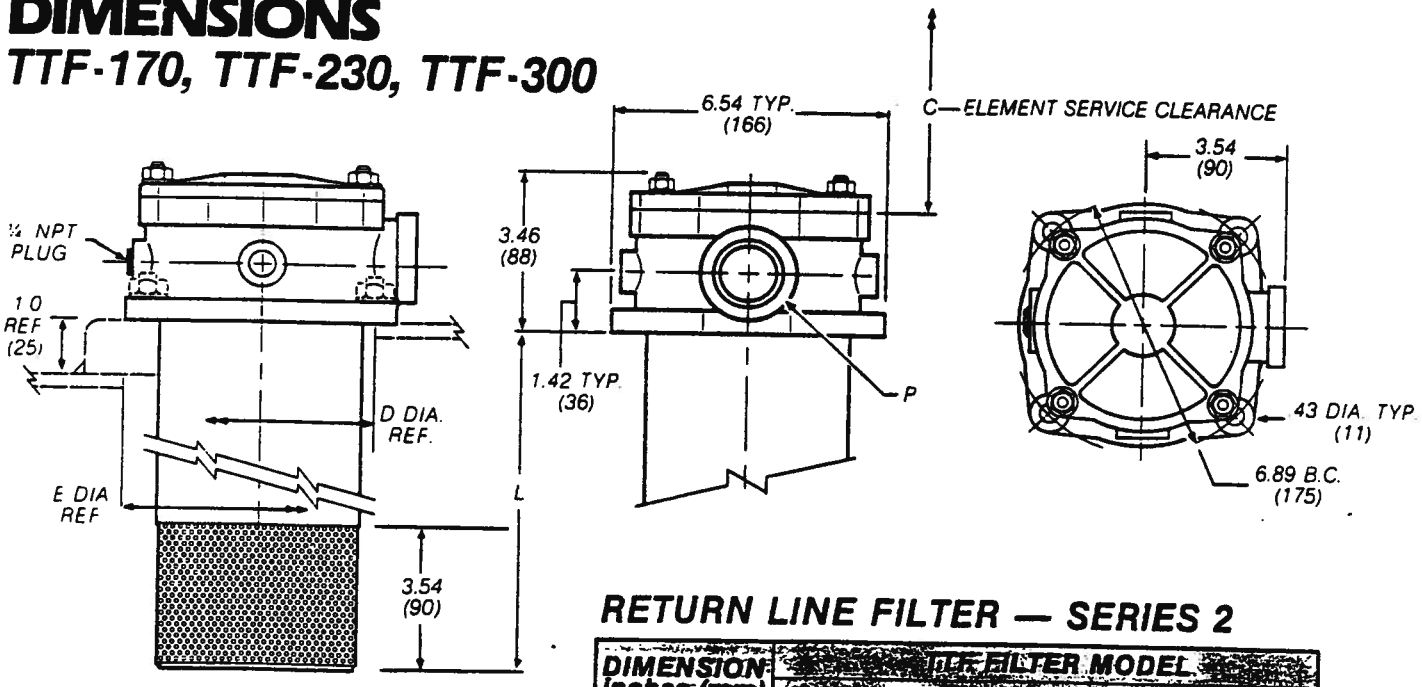


RETURN LINE FILTER — SERIES 1

DIMENSION Inches (mm)	TTF FILTER MODEL		
	60	90	120
C	6.25 (159)	8.0 (203)	10.0 (254)
L	9.25 (235)	11.0 (280)	13.0 (330)
	1" NPT or 16 SAE Straight Thread O-Ring		
D	3.66/3.56 (93/90)		
E*	4.50/3.75 (114/95)		

*E dimension using weld plate

DIMENSIONS
TTF-170, TTF-230, TTF-300



RETURN LINE FILTER — SERIES 2

DIMENSION Inches (mm)	TTF FILTER MODEL		
	170	230	300
C	11.0 (279)	13.5 (343)	21.5 (546)
L	12.0 (305)	12.0 (305)	20.0 (508)
	1½" NPT or 24 SAE Straight Thread O-Ring		
D	5.36/5.26 (136/133)		
E*	6.25/5.50 (159/140)		

*E dimension using weld plate

HOW TO SIZE TANK TOP FILTERS

The nomograph can either be used to determine the filter size with a given pressure drop, oil viscosity, filter media and flow rate OR the nomograph can be used to determine the pressure drop with a given filter size, flow rate, filter media and oil viscosity.

To Determine Filter Size

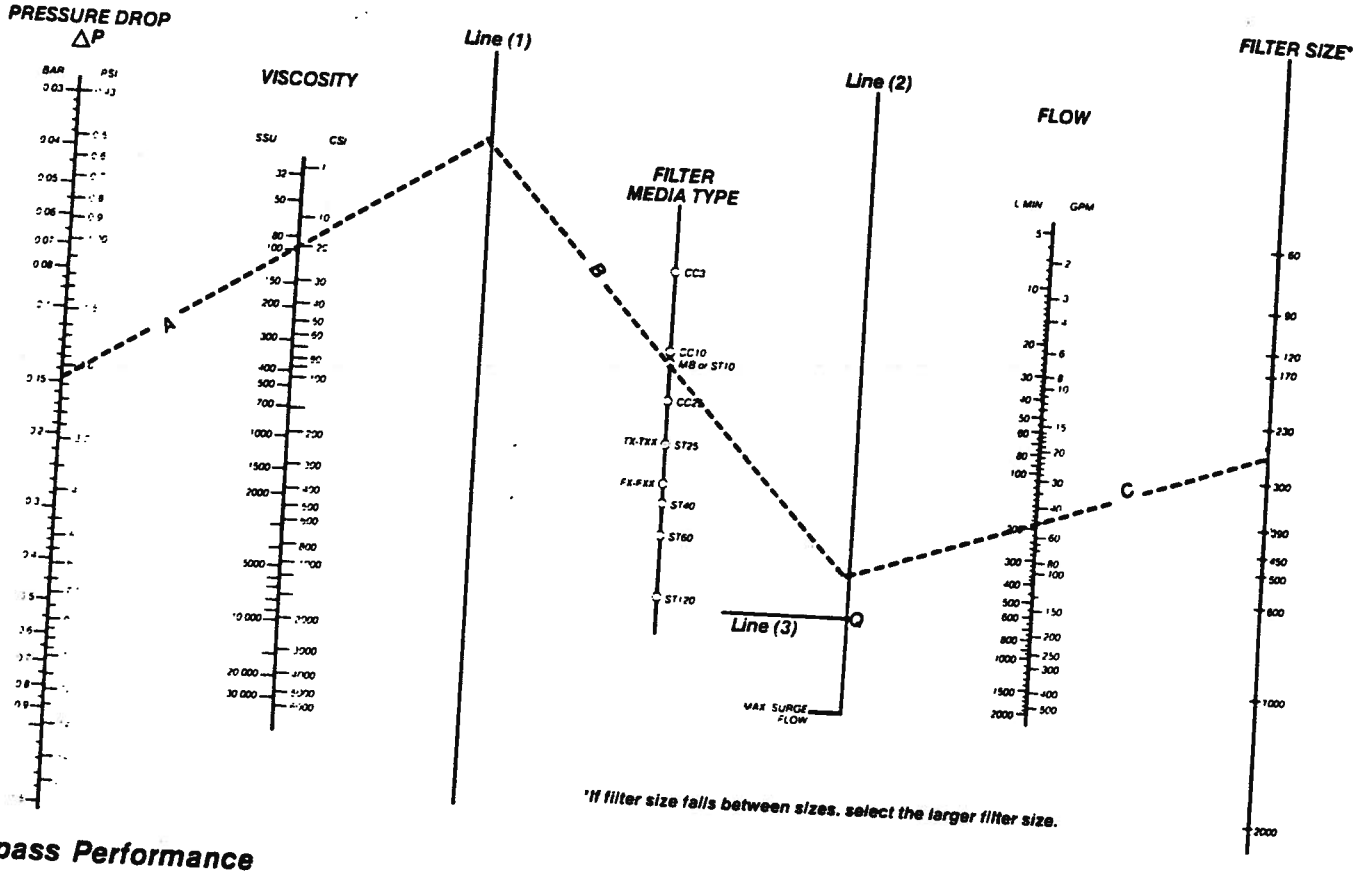
Given:
Pressure Drop Desired (Clean Filter): 2.2 PSI (.15 BAR)
Viscosity: 100 SSU (20 CSt)
Filter Media: MB
Flow Rate: 50 GPM (189 L/min)
Solution: Line represented by ———

1. *From the pressure drop value (2.2 psi) draw a line "A" through the viscosity line (100 SSU) to line "1".*
2. *From the point on line "1" draw a line "B" crossing the filter media MB to line "2". (In case line "B" meets line "3" point "Q" must be used as the next starting point.)*
3. *From line "2" or point "Q" draw a line "C" crossing the flow line at 50 gpm to the filter size line. A point between 230 and 300 is located, therefore select a size 300 filter.*

Note: *The portion of line "2" below point "Q" should be used only for surge flows.*

NOMOGRAPH FOR CLEAN ELEMENT PRESSURE DIFFERENTIAL

(Based on 0.88 specific gravity fluids)



*If filter size falls between sizes, select the larger filter size.

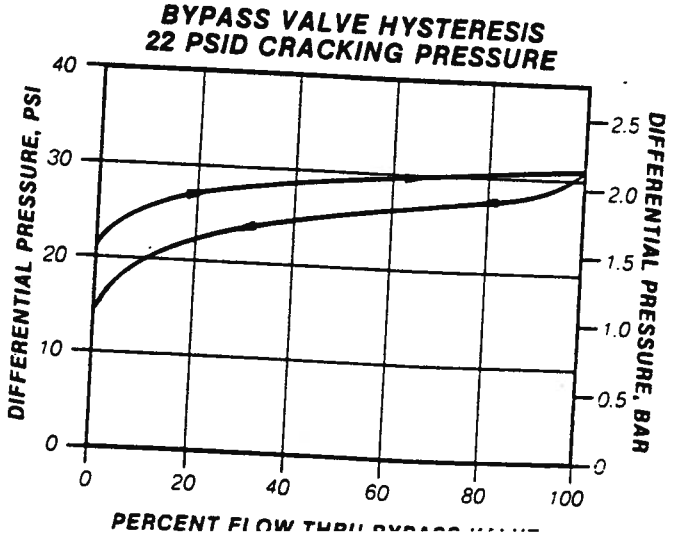
Bypass Performance

The TTF and BGTS Filters feature Fairey Arlon's low hysteresis, high flow bypass system. Due to the large valve area, element movement is less than 1/8 inch for full bypass flow. Since closed and open effective areas are similar, bypass hystersis is very low. Low bypass hystersis assures proper bypass closure after cold start-up.

The pressure drop versus bypass flow curve is given as a percent of full rated flow. The 100 percent, full rated flow values for the TTF and BGTS Filters are as follows:

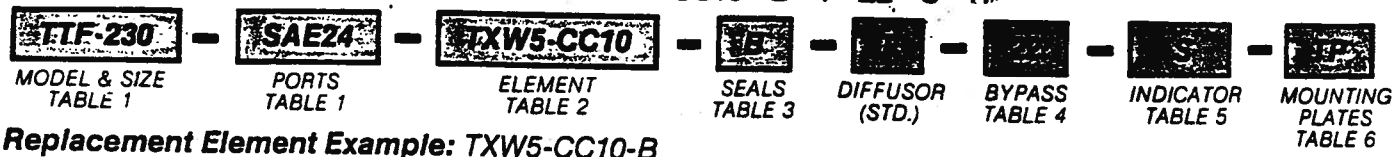
MODELS SERIES	FULL RATED BYPASS FLOW
TTF-60, 90, 120	32 GPM (121 L/min)
TTF-170, 230, 300	80 GPM (303 L/min)
BGTS-390, 500	135 GPM (510 L/min)

Full flow bypass differential pressure can be calculated for lower maximum flow rates by interpreting the Percent Flow Through Bypass Valve coordinate as the full scale for that lower flow. This will produce conservative differential pressures values. Thus, actual performance will always be better.



HOW TO ORDER TTF and BGTS TANK TOP FILTERS

Assembly Example: *TTF - 230 - SAE24 - TXW5 - CC10 - B - T - 22 - S - TP*



MODEL & SIZE TABLE 1 — PORTS TABLE 1 — ELEMENT TABLE 2 — SEALS TABLE 3 — DIFFUSOR (STD.) — BYPASS TABLE 4 — INDICATOR TABLE 5 — MOUNTING PLATES TABLE 6

Replacement Element Example: *TXW5-CC10-B*

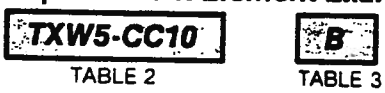


TABLE 2 — TABLE 3

TABLE 1: MODEL, SIZE & PORTS

MODEL & SIZE CODE	FLOW, GPM		PORT TYPE AND SIZE CODE		
	FULL	SURGE	NPT	SAE THREAD	SAE FLANGE
TTF-60	22	36	1" NPT	SAE16	NA
TTF-90	32	48			
TTF-120	42	60			
TTF-170	50	80	1½" NPT	SAE24	
TTF-230	60	100			
TTF-300	80	120			
BGTS-390	105	150	NA	NA	32 FLG
BGTS-500	135	200			

NA: Not available. Flange is SAE code 61, 3000 lb. design

TABLE 3

SEAL CODE	MATERIAL
B	BUNA-N
V	VITON-A

BUNA-N Standard

TABLE 4

BYPASS CODE	BYPASS CRACKING PRESSURE
B	BLOCKED
12	12 PSID
22	22 PSID

22 PSID Standard
12 PSID for ST mesh elements

TABLE 5

INDICATOR CODE	DESCRIPTION	PERFORMANCE
G	MODEL 300024 0-30 PSIG GAUGE	100 PSIG MAXIMUM ABSOLUTE PRESSURE
S	MODEL GSIC-19R PRESSURE SWITCH 19 PSIG SET POINT	250 PSIG MAX SPDT SWITCH 5 AMP AT 220 VAC 10 AMP AT 110 VAC
OMIT	IF NOT REQUIRED	

TABLE 6

MOUNTING CODE	DESCRIPTION OPTIONAL TANK WELD PLATES
TP	TOP OF TANK WELD PLATE
OMIT	IF NOT REQUIRED

TABLE 2

	ELEMENT CODES					
	DISPOSABLE					RECLEANABLE
	MB SERIES	TX SERIES	BETA MAZE SERIES			ST SERIES*
MODEL	HIGH EFFICIENCY 10 MICRON BETA 10 ≥ 2.5	10 MICRON NOMINAL BETA 10 ≥ 1.2	3 MICRON ABSOLUTE BETA 3 ≥ 75	10 MICRON ABSOLUTE BETA 10 ≥ 75	25 MICRON ABSOLUTE BETA 25 ≥ 75	RECLEANABLE STAINLESS STEEL MESH ELEMENTS
TTF-60	MB2	TX2-10	TXW2-CC3	TXW2-CC10	TXW2-CC25	ST2-
TTF-90	MB3	TX3-10	TXW3-CC3	TXW3-CC10	TXW3-CC25	ST3- 10
TTF-120	MB3D	TX3D-10	TXW3D-CC3	TXW3D-CC10	TXW3D-CC25	ST3D- 25
TTF-170	MB4	TXX4-10	TXW4-CC3	TXW4-CC10	TXW4-CC25	ST4- 40
TTF-230	MB5	TXX5-10	TXW5-CC3	TXW5-CC10	TXW5-CC25	ST5- 60
TTF-300	MB5A	TXX5A-10	TXW5A-CC3	TXW5A-CC10	TXW5A-CC25	ST5A- 120
BGTS-390	MB8A	TXX8A-10	TXW8A-CC3	TXW8A-CC10	TXW8A-CC25	ST8A- (Microns
BGTS-500	MB8C	TXX8C-10	TXW8C-CC3	TXW8C-CC10	TXW8C-CC25	ST8C- Absolute)

ST Element Example ST5-10; 10 Micron Absolute *Coarser Ratings Available. Consult Factory

ELEMENT DATA

MEDIA TYPE	ABSOLUTE RATING	MULTI PASS TEST RESULTS TO ISO 4572 (TIME WEIGHTED AVERAGES)						
		B_3	B_6	B_{10}	B_{12}	B_{20}	B_{25}	B_{40}
CC	3	≥75	300	800	2000	>5000	∝	∝
CC	10	6	20	≥75	>100	>1000	>3000	∝
CC	25	—	—	5	8	25	≥75	∝
TX/TXX	40	—	—	2.6	3.5	5	6.5	≥200
MB	25	—	1.5	2.5	4	25	≥75	2000
ST	SEE TABLE 2							

CC = Glass Micro-fiber, Epoxy End Cap Adhesive, Suitable for all Conventional Hydraulic Fluids except Phosphate Esters
TXX/TX = Cellulose Fiber, Epoxy End Cap Adhesive, Suitable for Petroleum Base Fluids Only
MB = Cellulose Fiber, Plastisol End Cap Adhesive, Suitable for Petroleum Base Fluids Only
ST = Stainless Steel Mesh. Epoxy End Cap Adhesive, Suitable for all Conventional Hydraulic Fluids except Phosphate Esters

Consult fluid manufacturer for recommended seal materials.

National FLUID POWER Association
MEMBER

Because of our policy of continuing Product Improvement, published data and specifications are subject to change without notice.

 Form No., TTF/BGTS 1/93 Printed in U.S.A.

Fairey Arlon Inc.
P.O. Box 807 / 2920 99th St.
Sturtevant, WI 53177
Phone: +1 414 886 0888
Fax: +1 414 886 6099

Pure technology

FAIREY® ARLON

HYDRAULIC COMPONENT

REFERENCE DWG # 425-B001-01/B009-01

ITEM # HX-1

MANUFACTURER: YOUNG, 2825 FOUR MILE ROAD RACINE, WI 53404 414-639-1011

DESCRIPTION: HEAT EXCHANGER - TUBE & SHELL

PART NUMBER: F502EY4PCNTB

MODEL IDENTIFICATION

TYPE CODE	SHELL DIAMETER CODE	SHELL LENGTH CODE	BAFFLE SPACING CODE	TUBE DIAMETER CODE	PASS CODE	OPTION CODE
(F)= fixed tube bundle with 150 psi 1040 kPa shell HF= fixed tube bundle with 250 psi 1725 kPa shell SSF= fixed tube bundle with 300 psi 2070 kPa shell and stainless steel materials	2=2.12 in 3=3.62 in (5)=5.12 in 6=6.12 in 8=8.25 in 10=10.75 in	01= 9 in (02)=18 in (03)=27 in 04=36 in 05=45 in 06=54 in 08=72 in 10=90 in	H=1.13 in D=2.25 in (E)=4.50 in A=9.00 in T=15 in (approx.)	(Y)=0.250 in OD R=0.375 in OD C=0.625 in OD	1P=one pass 2P=two pass (4P)=four pass	CN=90-10 copper nickel tube CNT=90-10 copper nickel tube and tube sheet B=brass bonnet CNB=90-10 copper nickel tube and brass bonnet (CNTB)=90-10 copper nickel tube, tube sheet and brass bonnet

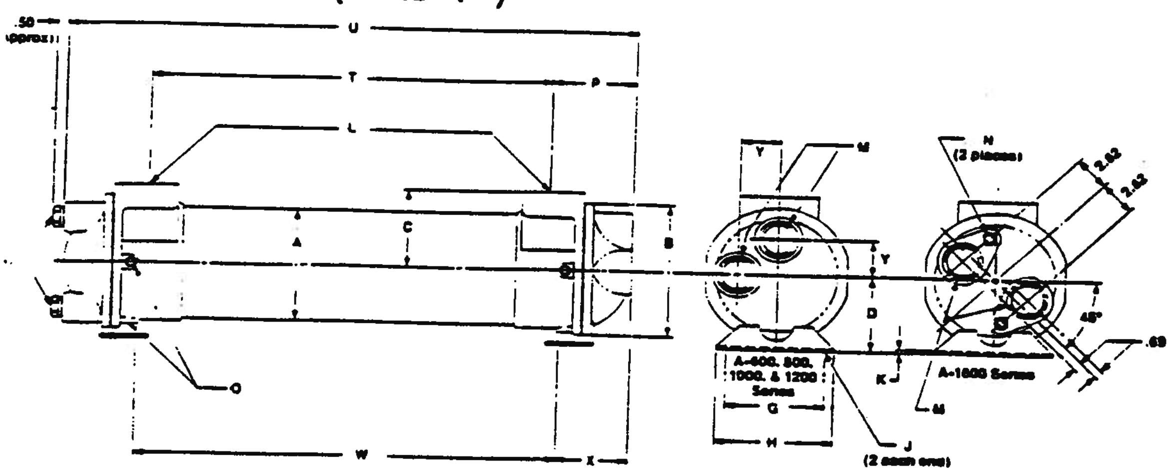
NOTE A. F TYPE CODE not available in 2 and 8 SHELL DIAMETER CODE.
NOTE B. HF TYPE CODE not available in 10 SHELL DIAMETER CODE.
NOTE C. HF-2 TYPE CODE. SHELL DIAMETER CODE not available in 2P or 4P PASS CODE.
NOTE D. CN OPTION CODE available with 10 SHELL DIAMETER CODE only all others are CNT OPTION CODE.

NOTE E: MODEL EXAMPLE –

F-604-AR-4P-CNT

- fixed tube bundle
- 6.12 in. shell diameter
- 36 in. nominal tube length
- 9.00 in. baffle spacing
- 0.375 in. tube
- four pass
- 90-10 copper nickel tube and tube sheet option

FOUR PASS (Code "F")



MODEL	N N.P.T.	M N.P.T.	P	U	X
A-608	.38	.75	2.31	10.88	2.81
A-614				16.88	
A-624				26.88	
A-814	.38	.75	3.44	17.62	2.56
A-824				27.52	
A-836				39.62	
A-1014	.38	1.00	3.56	18.38	3.25
A-1024				28.38	
A-1036				40.38	
A-1224	.50	1.50	4.25	29.00	3.75
A-1236				41.00	
A-1248				53.00	
A-1260				65.00	
A-1624	.50	2.00	6.00	30.75	5.25
A-1636				42.75	
A-1648				54.75	
A-1660				66.75	
A-1672				78.75	

COMMON DIMENSIONS

MODEL	A DIA.	B DIA.	C	D	G	H	J	K	L N.P.T.	O N.P.T.
A-408	2.12	—	1.69	—	—	—	—	—	1.00	—
A-608, A-614, A-624	3.12	4.19	2.44	2.44	2.50	3.50	.38 x .88	.12	1.00	(4) .25
A-814, A-824, A-836	4.12	5.88	3.12	3.50	3.50	4.75	.50 x 1.62	.12	1.50	(6) .38
A-1014, A-1024, A-1036	5.12	6.50	3.62	3.50	4.00	5.00	.50 x .88	.12	1.50	(6) .25
A-1224, A-1236, A-1248, A-1260	6.12	7.50	4.25	4.12	5.00	6.00	.50 x .88	.12	2.00	(6) .25
A-1624, A-1636, A-1648, A-1660, A-1672	8.00	9.75	6.62	[illegible]	7.00	[illegible]	[illegible]	[illegible]	3.00	(6) [illegible]

T	W	NET WT. (LBS)	MODEL
6.25	—	6	A-408
6.12	5.12	12	A-608
12.12	11.12	14	A-614
22.12	21.12	17	A-624
11.12	12.88	37	A-814
21.12	22.88	45	A-824
33.12	34.88	54	A-836
11.12	11.75	45	A-1014
21.12	21.75	55	A-1024
33.12	33.75	65	A-1036
20.50	21.50	75	A-1224
32.50	33.50	95	A-1236
44.50	45.50	115	A-1248
56.50	57.50	135	A-1260
19.00	20.50	170	A-1624
31.00	32.50	185	A-1636
43.00	44.50	220	A-1648
55.00	56.50	255	A-1660
67.00	68.50	290	A-1672

All dimensions in inches. Zinc anodes optional.

F HF SSF technical data

TECHNICAL SPECIFICATIONS

MECHANICAL DESIGN DATA

RATINGS		TYPE CODE F		TYPE CODE HF		TYPE CODE SSF	
Maximum operating pressure psi kPa	Shell	150	1040	250	1725	300	2070
	Tube	150	1040	150	1040	150	1040
Test pressure psi kPa	Shell	250	1725	500	3450	500	3450
	Tube	250	1725	300	2070	300	2070
Maximum operating temperature F C	Shell	350	177	350	177	400	204
	Tube	350	177	350	177	400	204

MATERIAL DATA

COMPONENT	SHELL DIAMETER CODE	TYPE CODE F	TYPE CODE HF	TYPE CODE SSF
Shell	2 and 8	—	brass	stainless steel
	3, 5 and 6	brass	steel	
	10	steel	—	
Baffle	10	steel		
Tube	All	copper (Cu-Ni if OPTION CODE includes CN)		
Tube sheet	All	brass (Cu-Ni if OPTION CODE includes CNT)		
Bonnet	All	cast iron (cast brass if OPTION CODE includes B)		316 stainless steel casting
Hub	All	brass		
Pipe Plug Shell	All	same material as shell		
Bonnet	All	steel (brass if OPTION CODE includes B)		316 stainless steel
Mounting Brkt.	All	steel		steel

NOTE F. The differential between the shell fluid average temperature and tube fluid average temperature should not exceed 200F 93C for models through 06 SHELL LENGTH CODE and 150F 70C for longer models. For temperature differences exceeding these limits heat exchangers should be furnished with expansion joints. To eliminate high pressure surges a pressure relief valve, accumulator or other suitable device should be used with a hydraulic system.

NOTE G. One pass heat exchangers should be used for steam service. Pressures to 15 psig 520 kPa (maximum) and temperatures to 350F 177C (maximum) may be used. Steam should be admitted through the tube side, with the exchanger mounted vertically to permit condensate to drain. A trap of proper type and size should be used. Horizontal installation can be accomplished if the heat exchanger is pitched at least 0.5 in/ft 4 cm/m of tube length.

PHYSICAL DATA

SHELL DIAMETER and LENGTH CODE	SHELL FLUID VOLUME gal l		TUBE FLUID VOLUME gal l		OUTSIDE TUBE SURFACE ft² m² TUBE DIA. CODE Y		TUBE DIA. CODE R		SHIPPING WEIGHT lbs kg	
201	0.15	0.57	0.10	0.38	1.52	0.14	—	—	7	31
202	0.15	0.57	0.15	0.57	3.04	0.23	—	—	10	44
301	0.20	0.76	0.15	0.57	3.74	0.33	2.66	0.24	17	75
302	0.50	1.9	0.30	1.1	7.47	0.69	5.31	0.48	25	110
303	0.70	2.6	0.40	1.5	11.1	1.03	7.97	0.73	30	130
502	1.0	3.8	0.50	1.9	18.1	1.68	11.2	1.04	40	180
503	1.5	5.7	0.75	2.8	27.1	2.52	16.8	1.56	50	220
504	2.0	7.6	1.0	3.8	36.1	3.35	22.4	2.08	60	270
602	1.2	4.5	0.90	3.4	26.9	2.50	17.5	1.63	55	240
603	1.9	7.2	1.3	4.9	40.2	3.73	26.2	2.43	70	310
604	2.5	9.5	1.6	6.1	53.6	4.98	34.9	3.24	90	400
606	3.7	14	2.4	9.1	80.8	7.51	52.7	4.90	130	590
608	5.0	19	3.1	12	108	10.0	70.2	6.52	170	760
802	2.4	9.1	1.8	6.8	—	—	34.1	3.17	155	690
803	3.6	14	2.4	9.1	—	—	50.6	4.70	180	800
804	4.7	18	3.1	12	—	—	67.1	6.23	205	910
805	5.8	22	3.7	14	—	—	83.6	7.77	230	1000
806	6.9	26	4.4	17	—	—	100	9.29	265	1200
808	9.1	34	5.6	21	—	—	133	12.4	325	1400
810	11	42	6.9	26	C		166	15.4	405	1900
1005	11	42	7.1	27	74.0	6.87	130	12.1	670	3000
1006	13	49	8.5	32	89.0	8.27	157	14.6	720	3200
1008	18	68	11	42	119	11.1	210	19.5	820	3600
1010	22	83	14	53	149	13.8	263	24.4	920	4100

CORRECTION TO CAPACITY FACTOR REQUIRED

SHELL LIQUID TYPE	Tsi (temperature of shell liquid at inlet) F C 120 49	150 66	200 93	250 121
SAE 5 oil	1.09	1.03	0.93	0.85
SAE 10 oil	1.19	1.10	1.00	0.92
SAE 20 oil	1.28	1.19	1.06	0.96
SAE 30 oil	1.32	1.27	1.09	0.99
SAE 40 oil	1.37	1.28	1.14	1.02
polyglycol	0.78	0.77	0.72	0.69
phosphate ester	0.67	0.65	0.62	0.60
water	0.59	0.58	0.57	0.57
50% ethylene glycol in water	0.65	0.64	0.62	0.60

OIL VISCOSITY

CENTIPOISES = CENTISTOKES X SPECIFIC GRAVITY
For SI Conversion: 1 kg/m-s = 1000 Centipoises

OIL TYPE	VISCOSITY @ 100 F 37.8 C SUS	Centistokes	Centipoise	VISCOSITY @ 210 F 98.9 C SUS	Centistokes	Centipoise
SAE 5	110	24	22	41	4.5	4.0
SAE 10	160	35	32	44	5.5	5.0
SAE 20	270	60	55	50	7.5	7.0
SAE 30	500	110	100	63	11	10
SAE 40	750	170	155	76	14.5	13
polyglycol	210	45	47	52	7.7	7.6
phosphate ester	250	56	66	43	5.1	5.8

LMTD (Logarithmic Mean Temperature Difference) F or C

Tsi — Tto F or C	Tso — Tti F or C 5	7	10	15	20	25	30	40	50	60	80	100	120
5	5.0	6.0	7.2	9.1	11	12	14	17	20	22	27	32	36
7	6.0	7.0	8.4	10	12	14	16	19	22	25	30	35	40
10	7.2	8.4	10	12	14	16	18	22	25	28	34	39	44
15	9.1	10	12	15	17	20	22	26	29	32	39	45	51
20	11	12	14	17	20	22	25	29	33	36	43	50	56
25	12	14	16	20	22	25	27	32	36	40	47	54	61
30	14	16	18	22	25	27	30	35	39	43	51	58	65
35	15	17	20	24	27	30	32	37	42	46	54	62	69
40	17	19	22	26	29	32	35	40	45	49	58	66	73
45	18	20	23	27	31	34	37	42	47	52	61	69	77
50	20	22	25	29	33	36	39	45	50	55	64	72	80
60	22	25	28	32	36	40	43	49	55	60	70	78	87
70	25	27	31	36	40	44	47	54	60	65	75	84	93
80	27	30	34	39	43	47	51	58	64	70	80	90	99
100	32	35	39	45	50	54	58	66	72	78	90	100	110
120	36	40	44	51	56	61	65	73	80	87	99	110	120

LIQUID TYPE	LIQUID CONSTANT Btu/gal-F	J/l-C
SAE 5 oil	3.5	1800
SAE 10 oil	3.5	1800
SAE 20 oil	3.5	1800
SAE 30 oil	3.5	1800
SAE 40 oil	3.5	1800
polyglycol	7.2	3600
phosphate ester	3.9	2000
water	8.3	4200
50% ethylene glycol in water	7.3	3700

capacity factor and pressure loss

TABLE 6

CAPACITY FACTOR and RATED PRESSURE LOSS of SHELL LIQUID

NORMALLY STOCKED TYPE				BASE MODEL	CAPACITY FACTOR Btu/min-F J/s-C @ liquid flow in shell, Fs, gpm l/s										RATED PRESSURE LOSS OF SHELL LIQUID psi	kPa
F	HF	SSF*	CNT**													
				Fs gpm l/s	2.0	0.13	4.0	0.25	6.0	0.38	8.0	0.50	10	0.63		
	•	•	•	201-HY	2.9	92	3.6	114	3.9	123	4.2	133	4.4	139		
	•	•		202-HY	5.8	183	7.2	228	7.9	250	8.3	262	8.7	275	9.1	63
				Fs gpm l/s	3.0	0.19	6.0	0.38	9.0	0.57	12	0.76	15	0.95		
•	•	•	•	301-HY	6.3	199	7.7	243	8.7	275	9.4	297	9.9	313	2.6	18
•	•	•	•	302-HY	13	420	16	518	18	579	19	610	20	638	8.3	57
•		•		303-HY	20	635	25	777	27	863	30	935	31	980	14.2	98
				Fs gpm l/s	5.0	0.32	10	0.63	15	0.95	20	1.3	25	1.6		
•				301-DY	6.9	218	8.4	265	9.3	294	9.9	313	11	332	3.0	21
•				302-DY	14	439	17	531	19	588	20	629	21	657	6.0	42
•				303-DY	21	657	25	796	28	882	30	942	31	989	9.3	62
				Fs gpm l/s	10	0.63	15	0.95	20	1.3	25	1.6	30	1.9		
•		•		301-EY	6.4	202	7.3	231	8.0	253	8.5	269	8.9	281	0.5	4
•	•	•	•	302-EY	13	408	15	465	16	506	17	547	18	566	1.1	8
•				303-EY	20	619	22	695	24	758	26	815	27	844	1.6	11
				Fs gpm l/s	5.0	0.32	10	0.63	15	0.95	20	1.3	25	1.6		
•	•			502-HY	33	1060	41	1310	46	1440	49	1540	51	1600	15.7	109
•				503-HY	51	1610	63	1990	69	2170	73	2300	76	2420	25.7	185
•				504-HY	69	2170	84	2670	93	2940	98	3090	104	3290	37.9	262
				Fs gpm l/s	10	0.63	20	1.3	30	1.9	40	2.5	50	3.2		
•	•			502-DY	35	1120	43	1340	47	1480	50	1570	52	1650	11.3	78
•				503-DY	52	1650	64	2020	71	2230	75	2360	78	2450	17.1	118
•				504-DY	69	2190	85	2690	94	2970	100	3150	104	3290	22.8	157
				Fs gpm l/s	15	0.95	25	1.6	35	2.2	45	2.8	55	3.5		
•	•	•	•	502-EY	32	1000	38	1190	41	1290	44	1400	46	1460	2.2	15
•		•	•	503-EY	48	1510	57	1790	61	1940	66	2070	69	2190	3.3	22
•		•		504-EY	64	2010	74	2340	82	2580	87	2760	92	2890	4.3	30
				Fs gpm l/s	30	1.9	40	2.5	50	3.2	60	3.8	70	4.4		
				502-AY	32	1000	35	1100	38	1190	39	1240	41	1310	0.6	4.0
				503-AY	53	1670	57	1800	60	1910	63	2000	66	2090	0.9	6
				504-AY	63	2000	70	2210	75	2360	78	2480	82	2600	1.2	8
				Fs gpm l/s	5.0	0.32	10	0.63	15	0.95	20	1.3	25	1.6		
•				602-HY	45	1410	56	1750	62	1960	67	2120	70	2220	8.8	61
				603-HY	70	2200	86	2710	97	3070	105	3290	110	3440	17.8	123
				604-HY	95	3000	115	3670	130	4110	140	4390	145	4610	27.2	188
				606-HY	140	4460	175	5590	195	6190	210	6570	—	—	40.6	280
				Fs gpm l/s	10	0.63	20	1.3	35	2.2	50	3.2	65	4.1		
•				602-DY	45	1420	56	1760	65	2040	71	2260	75	2370	5.7	40
•				603-DY	70	2220	87	2750	100	3150	110	3410	115	3600	11.8	81
•				604-DY	94	2970	115	3670	135	4230	145	4580	155	4830	17.9	124
				606-DY	145	4550	175	5560	205	6480	220	6950	230	7330	30.5	211
				608-DY	190	—	235	7490	275	8630	300	9480	—	—	43.3	299
				Fs gpm l/s	20	1.3	40	2.5	60	3.8	80	5.0	100	6.3		
•				602-EY	50	1560	61	1930	67	2110	72	2260	75	2360	5.0	34
•				603-EY	74	2330	92	2910	100	3220	110	3440	110	3540	7.4	50
•			•	604-EY	99	3110	120	3820	135	4230	145	4520	150	4770	9.9	68
•				606-EY	150	4710	180	5750	200	6380	215	6760	225	7110	14.8	102
•				608-EY	196	6190	240	7650	270	8560	285	9010	305	9610	19.7	136
				Fs gpm l/s	40	2.5	60	3.8	80	5.0	100	6.3	120	7.6		
				602-AY	49	1550	56	1760	61	1920	64	2020	68	2130	1.2	8
				603-AY	81	2550	92	2900	97	3070	105	3250	110	3440	1.8	12
•				604-AY	98	3100	110	3540	120	3860	130	4040	135	4230	2.4	16
•				606-AY	150	4680	165	5280	165	5810	195	6160	200	6350	3.6	25
•				608-AY	195	6190	225	7080	240	7620	255	8090	270	8470	4.8	33
				Fs gpm l/s	2.0	0.13	5.0	0.32	8.0	0.50	11	0.69	14	0.88		
•				301-HR	3.7	117	5.0	158	5.8	183	6.3	199	6.6	207	1.6	11
•		•		302-HR	7.8	246	11	332	12	379	13	417	14	433	5.0	35
				303-HR	12	373	16	515	19	585	20	626	21	664	8.6	60
				Fs gpm l/s	10	0.63	15	0.95	20	1.3	25	1.6	30	1.9		
				301-DR	5.5	174	6.1	193	6.5	205	7.0	221	7.1	224	2.7	19
				302-DR	11	348	12	386	13	414	14	436	14	452	5.5	38
•				303-DR	16	518	19	588	20	619	21	651	22	679	8.2	57
				Fs gpm l/s	10	0.63	15	0.95	20	1.3	25	1.6	30	1.9		
•				301-ER	4.5	142	5.0	158	5.5	174	5.8	183	6.2	196	0.4	3
•				302-ER	8.8	278	10	319	11	348	12	370	12	389	0.8	6
•				303-ER	13	417	15	474	16	518	16	553	18	578	1.2	8
				Fs gpm l/s	4.0	0.25	8.0	0.50	12	0.76	16	1.0	20	1.3		
•		•		502-HR	18	581	23	736	26	806	28	872	29	910	7.9	55
•				503-HR	28	894	35	1110	39	1230	42	1320	44	1390	13.4	93
				504-HR	38	1210	47	1490	53	1670	56	1760	59	1850	19.1	132
				Fs gpm l/s	8.0	0.50	18	1.1	28	1.8	38	2.4	48	3.0		
•				502-DR	20	616	25	787	27	866	29	926	31	970	7.5	52
				503-DR	29	913	37	1170	42	1320	44	1390	46	1460	11.3	78
				504-DR	39	1220	490	1548	55	1740	59	1850	62	1940	15.1	104
				Fs gpm l/s	15	0.95	25	1.6	35	2.2	45	2.8	55	3.5		
•		•	•	502-ER	19	594	22	705	24	771	26	825	27	866	1.6	11
•				503-ER	29	904	33	1060	37	1150	39	1240	41	1300	2.5	17
				504-ER	38	1190	44	1400	49	1550	53	1660	55	1720	3.2	22

*SSF 4P PASS CODE not available from stock.

**CNT OPTION CODE stocked for type F units except for 2 and 8 SHELL DIAMETER CODES which are stocked for type HF. Stocked 10 SHELL DIAMETER CODE are CN OPTION CODE. CNT OPTION CODE not available.

HYDRAULIC COMPONENT

REFERENCE DWG #435-8001-01/8009-01

ITEM # — LG-1

MANUFACTURER: LUBE DEVICES, 2042 WAGLE AV MANITOWOC, WI 54220 414-682-6877

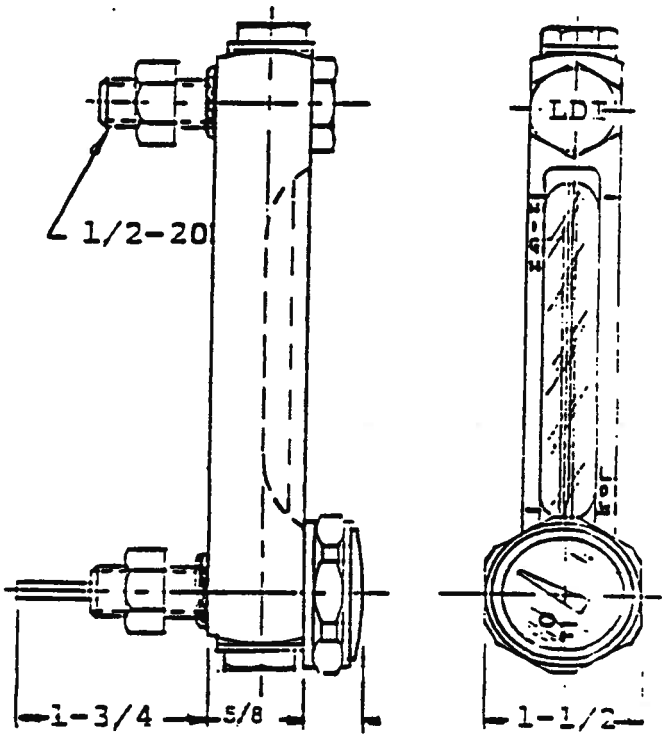
DESCRIPTION: LEVEL GAUGE - TRANSPARENT TYPE

PART NUMBER: G615-05-A-1

ES G615 (with thermometer)

ES No.	A CENTERS	B SIGHT	C LENGTH
G615	3	1-1/2	4-5/8
G615	4	2-1/2	5-5/8
G615	5	3-1/2	6-5/8
G615	6	4-1/2	7-5/8
G615	7	5-1/2	8-5/8
G615	8	6-1/2	9-5/8
G615	9	7-1/2	10-5/8
G615	10	8-1/2	11-5/8
G615	11	9-1/2	12-5/8
G615	12	10-1/2	13-5/8

AVAILABLE 3" THRU 142" MOUNTING CENTERS



HOW TO ORDER:

GAGES ARE AVAILABLE WITH MOUNTING CENTERS UP TO 142" IN 1" INCREMENTS. WHEN ORDERING, SEE "HOW TO ORDER". NOTE: SIGHT OPENING IN ALL CASES IS 1-1/2", LESS THAN MOUNTING CENTERS AND OVER-ALL LENGTH IS 1-5/8" GREATER THAN MOUNTING CENTERS.

GAGES WITH 13" AND GREATER MOUNTING CENTERS ARE FURNISHED WITH SPACER SLEEVES TO SPACE GAGE FROM TANK TO ALLOW FOR BOWING OF THE TANK WALL IN LARGER RESERVOIRS.

CENTER MOUNTING KIT IS FURNISHED WITH GAGES 48" AND GREATER MOUNTING CENTERS.

STAINLESS STEEL DIAL THERMOMETERS: 1-3/8 DIAMETER FAHRENHEIT DIAL (0 TO 300°) IS STANDARD. ALSO AVAILABLE WITH 1-3/8 DIAMETER CENTIGRADE DIAL (-20 TO 150°). IF CENTIGRADE DIAL THERMOMETER IS WANTED - SPECIFY. FOR G615 AND G620 SERIES, SEE BACK SIDE.

HYDRAULIC COMPONENT

REFERENCE DWG # 425-8001-01/8009-01

ITEM # LFV-1 ; LFV-2

MANUFACTURER: SUNDSTRAND, 2800 E. 13TH ST. ANOKA, MN 55303 (612) 421-3330

DESCRIPTION: Loop Flushing Valve

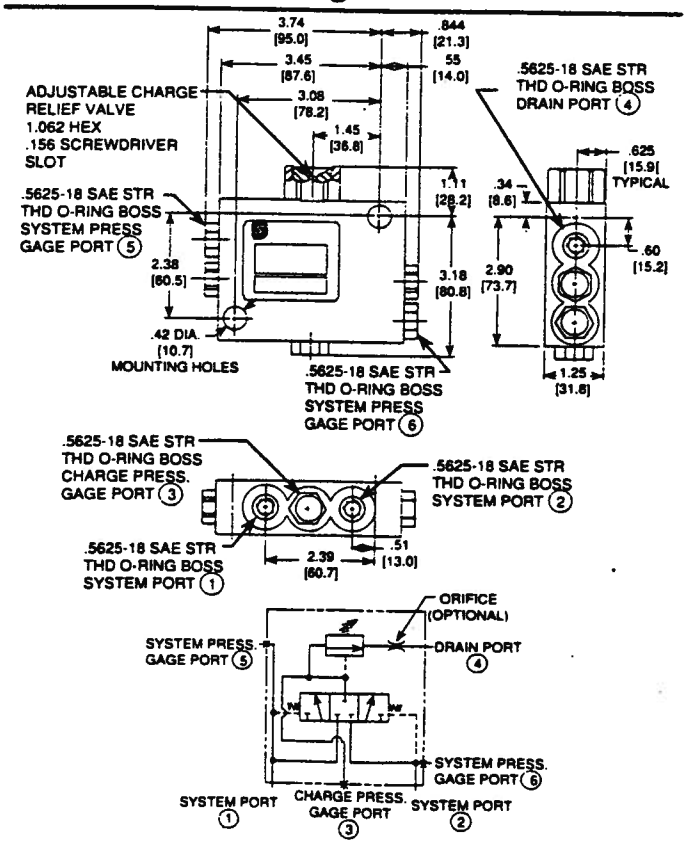
PART NUMBER: 8800 485-2400

The Loop Flushing Valve should be considered when any of the following exist:

- Sustained operation at low pressure and high speed
- Operation where continuous pressure exceeds the 1000 hours/year rating
- Cylinders in the hydrostatic circuit
- Flow restricting valves in the power loop
- Frequent operation of high pressure relief valves
- Long power loop lines
- Extraordinary life requirements

Monitoring of fluid quality under field operating conditions for extended periods of time is recommended in a determination of requirements for loop flushing. For a complete discussion of loop flushing and fluid quality refer to Sundstrand-Sauer Bulletins BLN-9886 "Transmission Circuit Recommendations" and BLN-9887 "Fluid Quality Requirements."

Installation Drawing



Description of Operation

The high pressure ports (1 and 2) of the valve are externally connected to the work or system auxiliary ports of the main hydrostatic transmission circuit. The valve drain port (4) must be externally connected to the case drain return line of the transmission — preferably at the motor so that fluid is flushed through the motor case to the pump and returned to the reservoir.

The shuttle valve responds directionally to high pressure, exposing the low pressure side of the circuit to the charge relief valve. The charge relief valve, when properly set in accordance with the "Adjustment Procedure," will flush a desired quantity of working fluid from the transmission power loop. This fluid is replaced from the charge replenishing flow entering the loop through an integral check valve system in the main pump.

A drain orifice may be specified to limit maximum flushing flow in circuits where the low side pressure is high or varies over a large pressure range.

Specifications

System Pressure (In Loop)

Maximum High Side	psi	6960
	BAR	480
Maximum Low Side	psi	1015
	BAR	70

Charge Relief Valve Setting Range

psi	44 to 435
BAR	3 to 30

NOTE: Nominal charge relief settings are ±20 psi (±1.4 BAR), and are set at a flow of 1 ±.25 gpm (3.8 ±.9 lpm) at 120°F (49° C).

Flow (Rated)

No Orifice	gpm	3
	lpm	11.4
With .093 Orifice	gpm	1
	lpm	3.8

Model Code

8800485— □□□□

Charge Pressure
15 = 15 Bar (220 PSI)
20 = 20 Bar (290 PSI)
24 = 24 Bar (350 PSI)

Orifice
00 = None
09 = .093 in. (2.36 mm) Dia.

HYDRAULIC COMPONENT

REFERENCE DWG # 425-8001-01/8009-01

ITEM # MGB-1, MGB-2

MANUFACTURER: SUNDSTRAND, 2800 E. 13TH ST. AMES, IOWA 50010 515-239-6000

DESCRIPTION: HYDRAULIC MOTOR - BIDIRECT. TYPE

PART NUMBER: SERIES 23

21-27 SERIES

SUNDSTRAND-SAUER
STANDARD MODEL SPECIFICATIONS
23 SERIES FIXED DISPLACEMENT MOTOR

SWASHPLATE DISPLACEMENTS	MANIFOLD VALVE FLOW RATE	MOUNTING FLANGE	CASE PORT	END CAP MAIN PORT
CUBIC IN/REV	10 GPM	SAE	SAE O-RING BOSS	A = 1-3000
18° = 5.43		C	7/8-14 UNF 2B	B = 1-6000

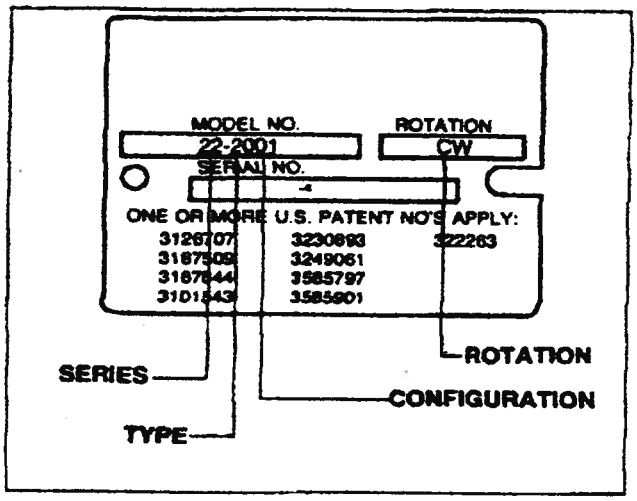
OUTLINE DRAWING
23-5302

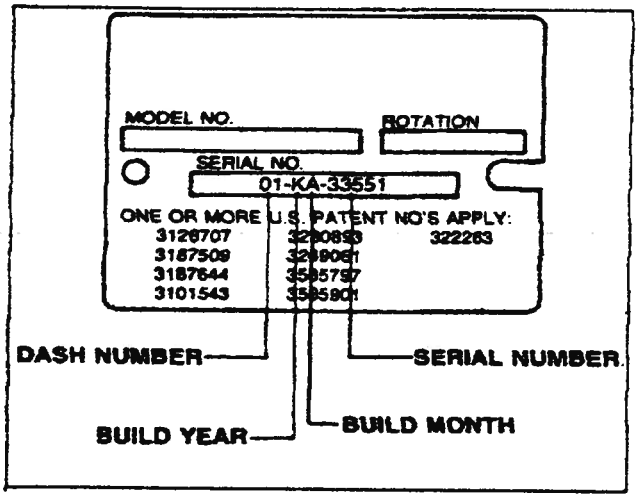
DRIVE SHAFT INFORMATION

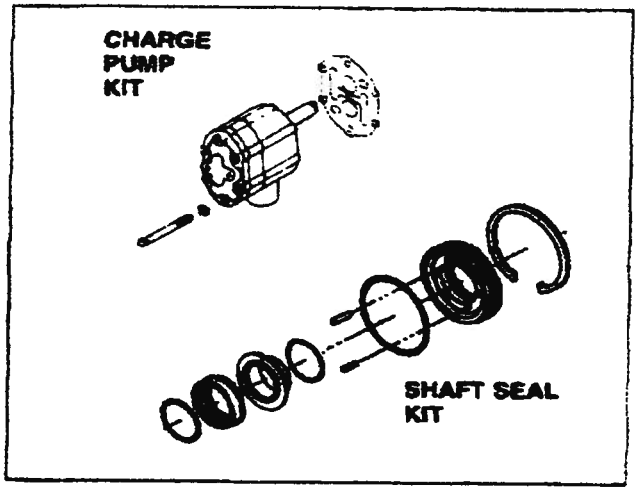
C =	14 T. SPLINE	1.2293 MAX. O.D. - 12/24 P
F =	21 T. SPLINE	1.3585 MAX. O.D. - 16/32 P
G =	23 T. SPL.-TAPD	1.4835 MAX. O.D. - 16/32 P 3/8-24
H =	23 T. SPL.-TAPD	1.4835 MAX. O.D. - 16/32 P 3/8-24 2.05" LENGTH
J =	27 T. SPL.-TAPD	1.7335 MAX. O.D. - 16/32 P 3/8-24
K =	STRAIGHT KEY	1.7500 MAX. O.D. - 3/8 X 3/8 X 2-1/2

MODEL 23-	SHAFT	END CAP	MANIFOLD	PISTON	COMMENTS
3501AN-	C	A	STD	FILLED	
3502AN-	C	A	STD	WELDED	
3503DN-	F	A	PLT RELIEFS	WELDED	
3504AN-	H	B	STD	WELDED	
3504DN-	H	B	PLT RELIEFS	WELDED	
3505AN-	H	A	STD	WELDED	
3506AN-	G	A	STD	FILLED	
3507AN-	F	A	STD	FILLED	
3508CN-	C	B	COVER	FILLED	
3509NN-	C	A	NONE	WELDED	END CAP NOT DRILLED

GENERAL PARTS IDENTIFICATION







Model Number

The Sauer-Sundstrand Model Number is necessary for identification of the specific unit. The Model Number must be used when ordering service parts.

The first two (2) digits identify the series size (20 through 27 Series).

The next digit identifies the unit type.

2 = Variable Displacement Pump
3 = Fixed Displacement Motor
4 = Variable Displacement Motor

The last three (3) digits (and the following letters on later model units) specifically identify such items as control, shaft, pressure settings, rotation, etc., in the records maintained by Sauer-Sundstrand.

Non-standard models will also have a non-standard model number on the identification plate.

Serial Number

The Sauer-Sundstrand Serial Number can be used to identify design configuration, build date, and units sequence in build.

The first two (2) digits are termed the dash number and are used to identify significant configuration changes (product improvements, etc.). Changes which affect interchangeability of parts are identified with a dash number change.

The year and month (earlier units) or year and week (later units) of build are also included in the serial number.

The Serial Number provides Sauer-Sundstrand with a tool to further identify a unit and should be included in communications regarding the servicing of the unit.

Parts Kits

Parts kits are available from Sauer-Sundstrand which contains all the parts necessary for replacement. The following kits are available, see parts list for specific model parts lists for kit numbers.

Charge Pump	Manifold
Shaft Seal	Control

Other kits are available on specific models.

CONFIGURATION: PUMPS AND MOTORS

114615-4

114602-1 123121-3

Heavy Duty Series and Types

The Heavy Duty Family of units consists of eight (8) different frame sizes (20 through 27 Series). Pumps and motors of different series (displacements) can be combined to meet the requirements of a variety of applications.

Within each series of the Heavy Duty Family of units there are three (3) configurations available: Variable Displacement Pumps, Fixed Displacement Motors, and Variable Displacement Motors.

The Variable Displacement Pump can be operated with fixed or variable input speeds and provides an infinitely variable output flow between 0 and maximum flow in either direction. A variety of controls are available for the Variable Displacement Pumps and Motors which are described on the following pages.

The Fixed Displacement Motor can be operated in either direction of rotation with infinitely variable output speeds between its 0 and maximum speed.

The Variable Displacement Motor provides a means for varying the motor output speed and torque range. Decreasing displacement results in higher output speed and lower output torque.

Specifications and Requirements

Sauer-Sundstrand Heavy Duty Hydrostatic transmissions have certain pressures that must be maintained as well as some requirements and limitations which must be observed.

SPECIFICATIONS

Model	Displacement		Maximum Recommended Working Pressure*		Max. Speed @ Max. Disp.
	IN³/REV.	CC/REV	PSI	BAR	(RPM)
20	2.03	33.2	5,000	345	3,800
21	3.15	51.6	5,000	345	3,500
22	4.26	69.8	5,000	345	3,200
23	5.43	89	5,000	345	2,900
24	7.24	118.6	5,000	345	2,700
25	10.12	165.8	5,000	345	2,400
26	13.87	227.3	5,000	345	2,100
27	20.36	333.6	5,000	345	1,900

*Operation of Series 20 units at 6000 PSI (414 BAR) maximum pressure requires the use of welded (non-filled) pistons.

SYSTEM REQUIREMENTS

Charge Pressure* (Neutral)	190 - 210 PSI	13 - 15 BAR
Charge Pressure * (Forward or Rev)	160 - 180 PSI	11 - 12.5 BAR
Case Pressure	40 PSIG Max.	3 BAR Max.
Inlet Vacuum**	10 in. Hg. Max.	0.7 BAR (abs.)
Suction Filtration	10 Micron Nominal, No Bypass Beta 10 = 1.5 to 2.0	

* Above case pressure. Some units may have special charge pressure settings. Consult machine specifications.

**Measured at charge pump inlet. (May be exceeded during cold weather start up).

V. SIZES AVAILABLE

(PUMPS AND MOTORS)

SERIES	DISPLACEMENT CU. IN./REV. 18°	MAXIMUM SHAFT SPEED**	FLOW GPM PER 1000 RPM * 18°(U.S.)	WEIGHT LBS.	(LB. FT.) TORQUE* PER 1000 P.S.I. 18°	WEIGHT LBS.
20	2.03	3800	8.8	97	27.0	48
21	3.15	3500	13.6	120	41.8	77
22	4.26	3200	18.4	140	56.6	88
23	5.43	2900	23.5	170	72.0	99
24	7.24	2700	31.3	277	96.0	154
25	10.12	2400	43.8	388	134.5	226
26	13.87	2100	60.0	487	184.0	292
27	20.36	1900	88.1	624	270.0	386

* Theoretical

** These speeds effective only on units factory built after January 1, 1971, Serial #LA40000

Revised 9-82

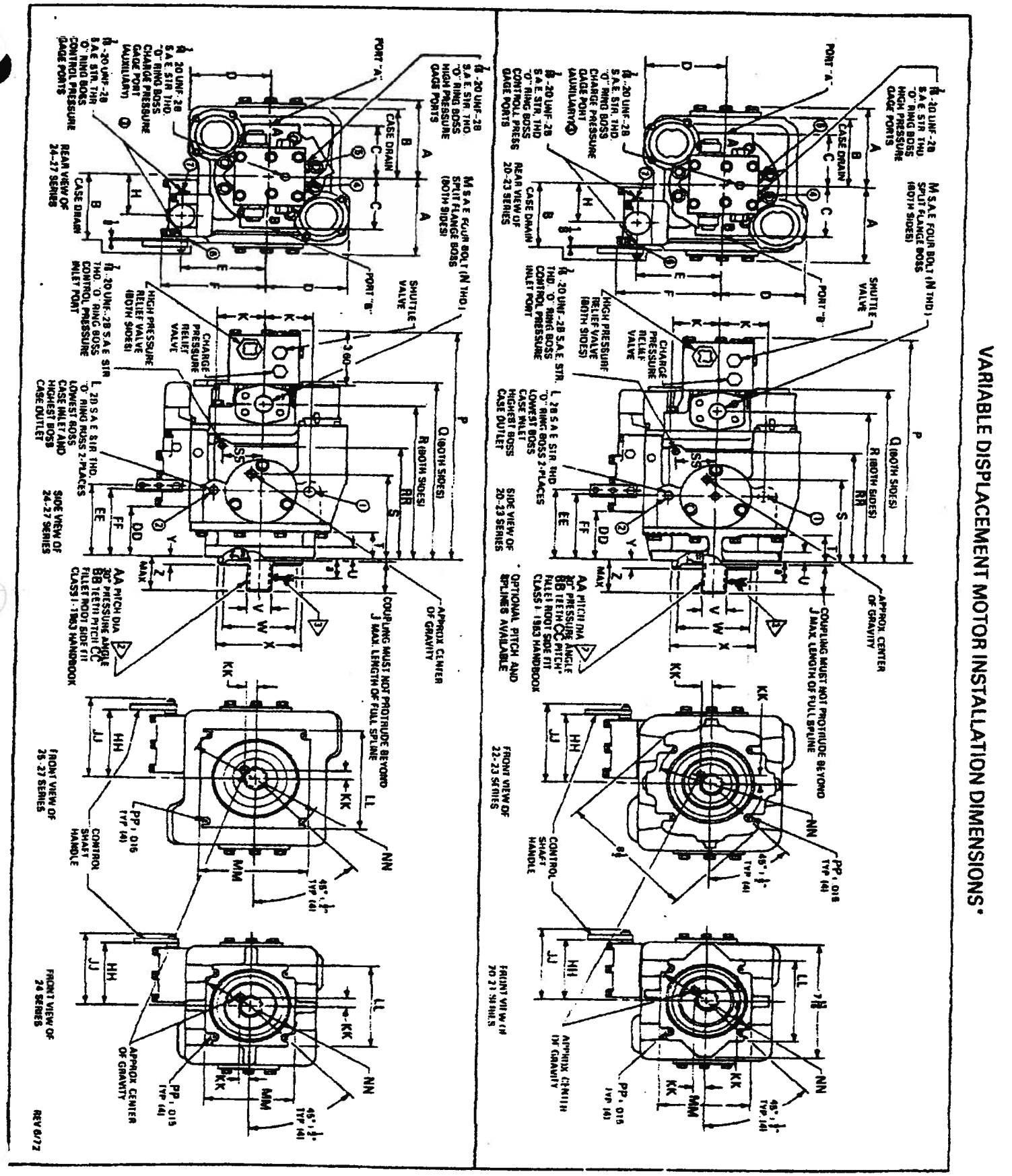
RATING CHART

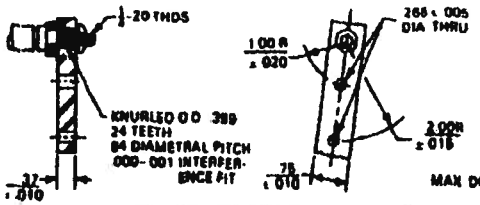
Series	Displacement Cu.In./Rev.	Max. Shaft Speed*	Corner Horsepower (CHP) 18° (PV/MF) Theo. (At Max. Shaft Speed and 5000 p.s.i.)
20	2.03	3800	97
21	3.15	3500	140
22	4.26	3200	173
23	5.43	2900	199
24	7.24	2700	247
25	10.12	2400	308
26	13.87	2100	368
27	20.36	1900	490

Contact Factory for Speed Limits on MV Transmissions.

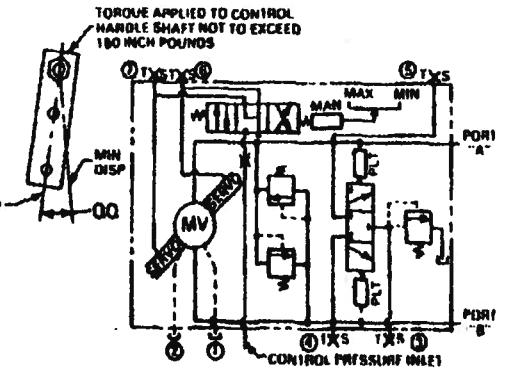
*These speeds effective only on units factory built after January 1, 1971, Serial #LA40000

VARIABLE DISPLACEMENT MOTOR INSTALLATION DIMENSIONS*





TYPICAL 20-27 SERIES



MAX DISPLACEMENT TT IN³/REV 118"]
MIN DISPLACEMENT UU IN³/REV 17"]
CHARGE PRESSURE RELIEF VALVE SET AT 180 180 P.S.I. ABOVE CASE PRESSURE
HIGH PRESSURE RELIEF VALVES SET AT 5000 & P.S.I. (STANDARD)
MAX CASE PRESSURE 40 P.S.I.G
MIN. MAIN PORT PRESSURE 130 P.S.I. ABOVE CASE PRESSURE
MAX CASE OIL TEMPERATURE 180°F
BEARING LIFE VV HRS @10 AT 3000 P.S.I. AND WW R.P.M. WITH NO EXTERNAL SHAFT LOAD
MAX SHAFT SPEED WW R.P.M. AT NO LOAD

CHARGE PRESSURE RELIEF VALVE FLOW RATING 10 G.P.M.

ALL NOTES UNLESS OTHERWISE SPECIFIED

2 NOTED SPLINE WILL FIT EITHER A FILLET ROOT OR FLAT ROOT FEMALE SPLINE

3 MAXIMUM RADIAL SHAFT LOAD (F) CALCULATED BY (F)=. YY 22 IN.-LBS. AT ANY ANGULAR POSITION

REF.	OUTLINE 20-SERIES	OUTLINE 21-SERIES	OUTLINE 22-SERIES	OUTLINE 23-SERIES	OUTLINE 24 SERIES	OUTLINE 26-SERIES	OUTLINE 26 SERIES	OUTLINE 27-SERIES
A	4-7/16	5	5-1/4	5-15/16	6-11/16	7-1/8	7-13/16	8-7/16
B	3-13/16	4-3/8	4-1/2	5-1/8	5-13/16	6-1/8	6-3/4	7-7/16
C	3-1/4	3-7/16	3-7/16	3-13/16	4-1/4	5-3/16	5-11/16	6-5/16
D	4-5/8	4-3/4	5	5-7/16	6-3/16	7-1/8	8-1/2	9-11/16
E	4-9/16	5-1/16	5-1/16	5-1/2	6	6-1/2	6 9/16	7 1/2
F	5	5-1/2	5 1/2	6-15/16	7 7/16	7-7/8	8 1/16	8 15/16
G	—	—	—	—	—	—	—	—
H	2-3/16	2-9/16	2 11/16	3-1/16	3 7/16	3 13/16	4 1/4	5
J	1.88	1.88	1.88	1.88	2.63	2.64	2.64	2.64
K	2-7/16	2-11/16	2-13/16	3-1/16	3 1/4	3-7/8	3-15/16	4-9/16
L	7/8-14UNF	7/8-14UNF	7/8-14UNF	7/8-14UNF	7/8 14UNF	1-5/16-12UN	1-7/8-12UN	1-16-12UN
M	1-3000	1-3000	1-3000	1-3000	1 3000	1-1/2 6000	1 1/2 6000	1 1/2 6000
N	3/8-16	3/8-16	3/8-16	3/8-16	3/8 16	5/8-11	5/8 11	5/8-11
P	14	14-11/16	15-3/16	15 3/4	16 1/2	20 5/16	21 3/8	23 1/16
Q	10 3/8	10-15/16	11 15/16	12-1/4	15 1/16	18 3/16	17 7/8	18
R	8-13/16	9-5/8	10-3/16	10-5/8	12-1/2	14-3/8	15 1/4	17
S	9-1/4	8	8-3/4	5-1/2	9 13/16	8-5/8	9 1/4	9 11/16
T	1-7/8	1-7/8	1-7/8	1-15/16	2-3/4	3-1/8	2-13/16	3-3/8
U	5/8	5/8	5/8	11/16	15/16	7/8	15/16	1
V	1.2293/1.2223	1.2293/1.2223	1.2293/1.2223	1.2293/1.2223	1.7210/1.7140	1.7210/1.7140	1.7210/1.7140	2.5460/2.5390
W	4-1/4	4-1/4	4-1/4	4-1/4	4-3/4	5	5	6-1/2
X	5.000-4.998	5.000-4.998	5.000-4.998	5.000-4.998	6.000-5.994	6.500-6.488	6.500-6.498	7.000-6.988
Y	.500-.480	.500-.480	.500-.480	.500-.480	.500-.480	.625-.605	.625 .605	.625-.605
Z	2.220	2.220	2.220	2.220	2.982	3.021	3.021	3.021
** AA	1.1667	1.1667	1.1667	1.1667	1.6250	1.6250	1.6250	2.5000
** BB	14	14	14	14	13	13	13	40
** CC	12/24	12/24	12/24	12/24	8/16	8/16	8/16	16/32
DD	2-1/8	2 9/16	3 1/16	3 5/16	5	6 1/8	6 7/8	7 15/16
EE	3 11/16	4 1/8	4 11/16	5	6 5/8	7 11/16	8 7/16	9 5/16
FF	3-15/16	4 3/16	4 3/8	4 5/8	6 13/16	8 3/4	8 3/8	7 13/16
GG	—	—	—	—	—	—	—	—
HH	3-15/16	4 5/16	4 7/16	4 7/8	5 3/16	5 9/16	6	6 13/16
JJ	4-13/16	5 1/4	5 5/16	5 3/4	6-1/8	6 1/2	6 15/16	7 11/16
KK	1/8	1/4	3/8	1/2	9/16	5/8	9/16	11/16
LL	8 1/16	8 1/16	—	—	8 3/4	14 7/8	11 7/8	12 1/2
MM	8 1/16	8-1/16	—	—	8 5/16	11 7/16	10 5/16	11 1/8
NN	8.375	8.375	8.375	8.375	8.000	12.500	12.500	13.781
PP	.69	.69	.69	.69	.84	.84	.84	1.09
QQ	12	14	14	17	14	18	19	17
RR	—	8-7/8	7-3/8	10-5/8	8-5/8	10 3/8	11 1/8	12 1/4
SS	—	2-1/8	2-3/8	2-9/16	2-11/16	2-15/16	3-1/8	3 3/4
TT	2.03	3.15	4.26	5.43	7.34	10.12	13.67	20.36
UU	.76	1.19	1.61	2.05	2.73	3.82	5.24	7.68
VV	8940	8270	8480	5880	10610	10710	7820	6580
WW	3600	3500	3200	2900	2700	2400	2070	1900
XX	—	—	—	—	—	—	—	—
YY	1.95	1.82	1.80	1.82	2.73	3.33		3.84
ZZ	2620	4900	6500	8620	9900	17700		51800

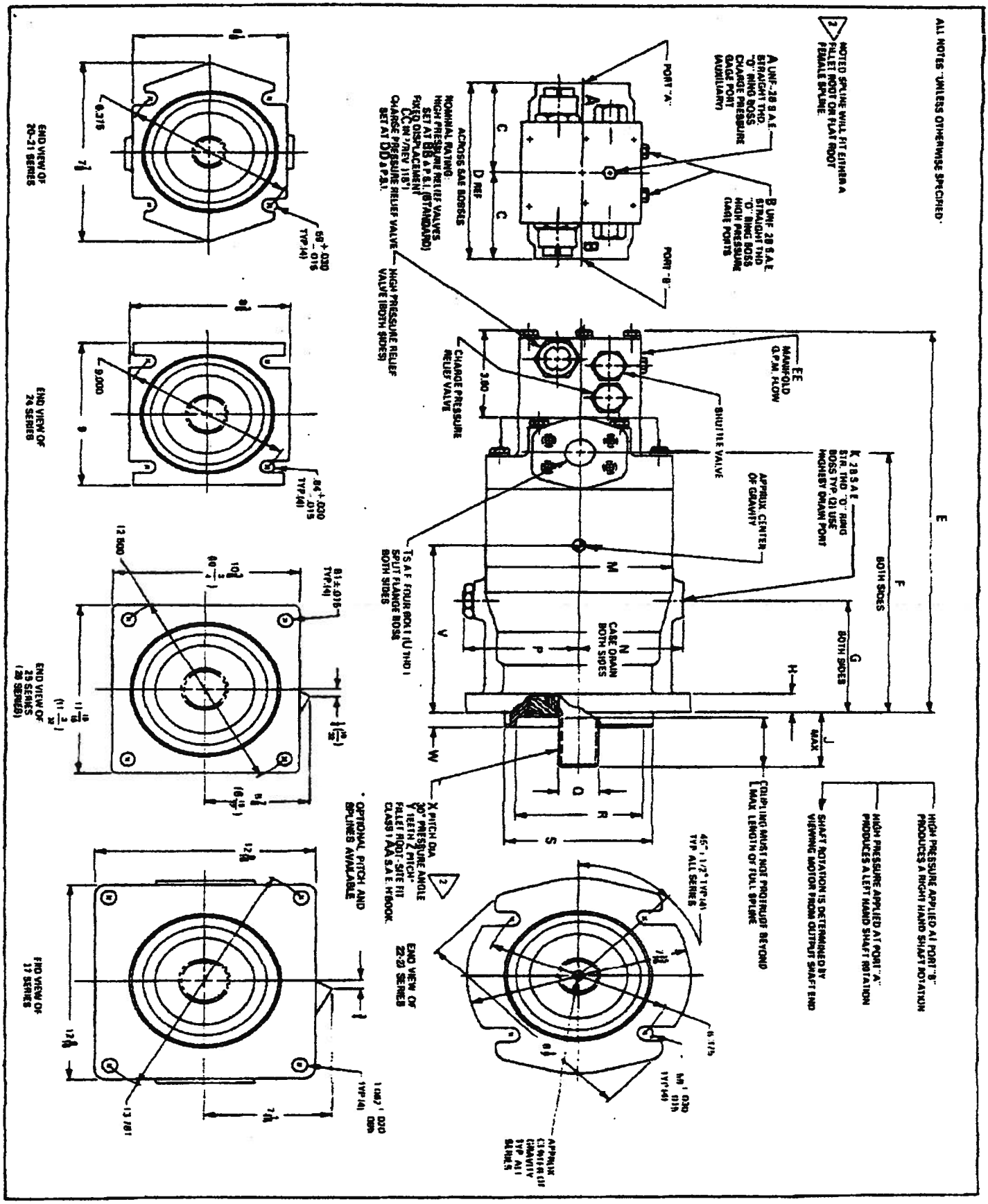
** OTHER SHAFTS AVAILABLE

VARIABLE DISPLACEMENT MOTOR

*FOR REFERENCE ONLY

REV. 0184

FIXED DISPLACEMENT MOTOR INSTALLATION OUTLINE DIMENSIONS*



REF.	OUTLINE 20-SERIES	OUTLINE 21-SERIES	OUTLINE 22-SERIES	OUTLINE 23-SERIES	OUTLINE 24-SERIES	OUTLINE 25-SERIES	OUTLINE 26-SERIES	OUTLINE 27-SERIES
A	7/16-20	7/16-20	7/16-20	7/16-20	7/16-20	7/16-20	7/16-20	7/16-20
B	7/16-20	7/16-20	7/16-20	7/16-20	7/16-20	7/16-20	7/16-20	7/16-20
C	3-1/4	3-7/16	3-7/16	3-13/16	4-1/4	5-3/16	5-3/4	6-5/16
D	6-1/2	6-7/8	6-7/8	7-5/8	8-1/2	10-3/8	11-1/2	12-5/8
E	13-9/16	14-5/16	15-1/16	15-3/4	17-5/8	18-15/16	19-3/4	21-5/16
F	8-7/16	9-1/4	10-1/16	10-5/8	12	13	13-5/8	15-1/4
G	3-1/2	3-13/16	4-1/4	4-5/8	4-15/16	5-3/8	5-1/2	6-1/16
H	5/8	5/8	5/8	11/16	1	7/8	1-1/16	1-1/2
J	2.220	2.220	2.220	2.220	2.962	3.021	3.021	3.021
K	7/8-14UNF	7/8-14UNF	7/8-14UNF	7/8-14UNF	7/8-14UNF	1-5/16-12UN	1-7/8-12UN	1-7/8-12UN
L	1.88	1.88	1.88	1.88	2.64	2.64	2.64	2.64
M	6-13/16	6-3/8	6-11/16	7-7/16	8-3/16	9-5/16	10-11/16	11-13/16
N	3	3-5/16	3-3/4	4-1/16	4-1/16	5	5-7/16	5-7/8
P	3-7/16	3-11/16	4-1/8	4-7/16	4-7/16	5-1/2	6-1/8	6-5/16
Q	1.2293/1.2223	1.2293/1.2223	1.2293/1.2223	1.2293/1.2223	1.7210/1.7140	1.7210/1.7140	1.7210/1.7140	2.5460/2.5390
R	4-1/4	4-1/4	4-1/4	4-1/4	4-3/4	5	5	5-1/2
S	5.000/4.998	5.000/4.998	5.000/4.998	5.000/4.998	6.000/5.998	6.500/6.498	6.500/6.498	7.000/6.998
T	1-3000	1-3000	1-3000	1-3000	1-3000	1-1/2-6000	1-1/2-6000	1-1/2
U	3/8-16	3/8-16	3/8-16	3/8-16	3/8-16	5/8-11	5/8-11	5/8-11
V	6-1/8	6-5/16	6-1/2	6-11/16	6-7/8	8-5/8	9	10-15/16
W	.500/.480	.500/.480	.500/.480	.500/.480	.500/.480	.625/.605	.625/.605	.625/.605
X	1.1667	1.1667	1.1667	1.1667	1.6250	1.6250	1.6250	2.5000
Y	14	14	14	14	13	13	13	40
Z	12/24	12/24	12/24	12/24	8/16	8/16	8/16	16/32
AA	1983	1983	1983	1983	1983	1983	1983	1983
BB	5000	5000	5000	5000	5000	5000	5000	5000
CC	2.03	3.15	4.26	5.43	7.24	10.12	13.87	20.30
DD	160/180	160/180	160/180	160/180	160/180	160/180	160/180	160/180
EE	10	10	10	10	10	10	10	0
FF	3-7/8	4-1/16	4-1/4	4-13/16	4-15/16	—	6-11/16	7-3/16

** OTHER SHAFTS AVAILABLE

FIXED DISPLACEMENT MOTOR

*FOR REFERENCE ONLY

REV. 0184

HYDRAULIC COMPONENT

REFERENCE DWG # 425-B001-01/B009-01

ITEM # MGB-1, MGB-2

MANUFACTURER: BREVINI, 1005 W. RAYEN AVE YOUNGSTOWN, OHIO 44502 216-747-3569

DESCRIPTION: GEARBOX

PART NUMBER: ET3400MN-142.3:1

THERMAL RATING

This is the continuous power transmittable by a gearbox with splash lubrication and maximum oil temperature of 90°C.
For higher powers, due to such limits of temperature, suitable cooling systems are required.
There are also the P_{MO} - maximum recommended operative rating - expressed for single to triple stage gear units: we advise not to exceed these ratings, even if using valid cooling systems.
Approximate values of the thermal rating, P_T are given in the table for following conditions:
— n_1 = 1500 min.$^{-1}$; horizontal mounting; in open air; ambient temperature: 20°C; lubrication oil VG150.
Table 2 enables adjustment for different ambient temperatures and intermittent duty.

THERMAL RATING ADJUSTEMENT FACTOR

WORKING TIME (%)	T° ROOM TEMPERATURE IN °C				
	10°	20°	30°	40°	50°
100	1,15	1	0,85	0,7	0,6
80	1,25	1,1	1	0,85	0,7
60	1,4	1,25	1,1	1	0,85
40	1,6	1,4	1,25	1,1	1
20	1,8	1,6	1,4	1,25	1,1

MAX OPERATING POWER P_{MO} (kW)

	1 STADIO/STAGE		2 STADI/STAGES		3 STADI/STAGES		4 STADI/STAGES	
	P_{TH}	P_{MO}	P_{TH}	P_{MO}	P_{TH}	P_{MO}	P_{TH}	P_{MO}
010	12	25	8	15	5	10	—	—
020/30	20	60	12	20	8	20	4	—
045/046	20	90	15	40	10	25	6	—
065	30	120	18	60	14	30	8	—
090/150	40	180	23	90	15	50	11	—
250	50	230	30	110	20	70	15	—
400	60	280	38	130	25	90	20	—
600	70	400	50	180	35	100	25	—
800	80	500	65	250	45	130	30	—

In line reduction gears

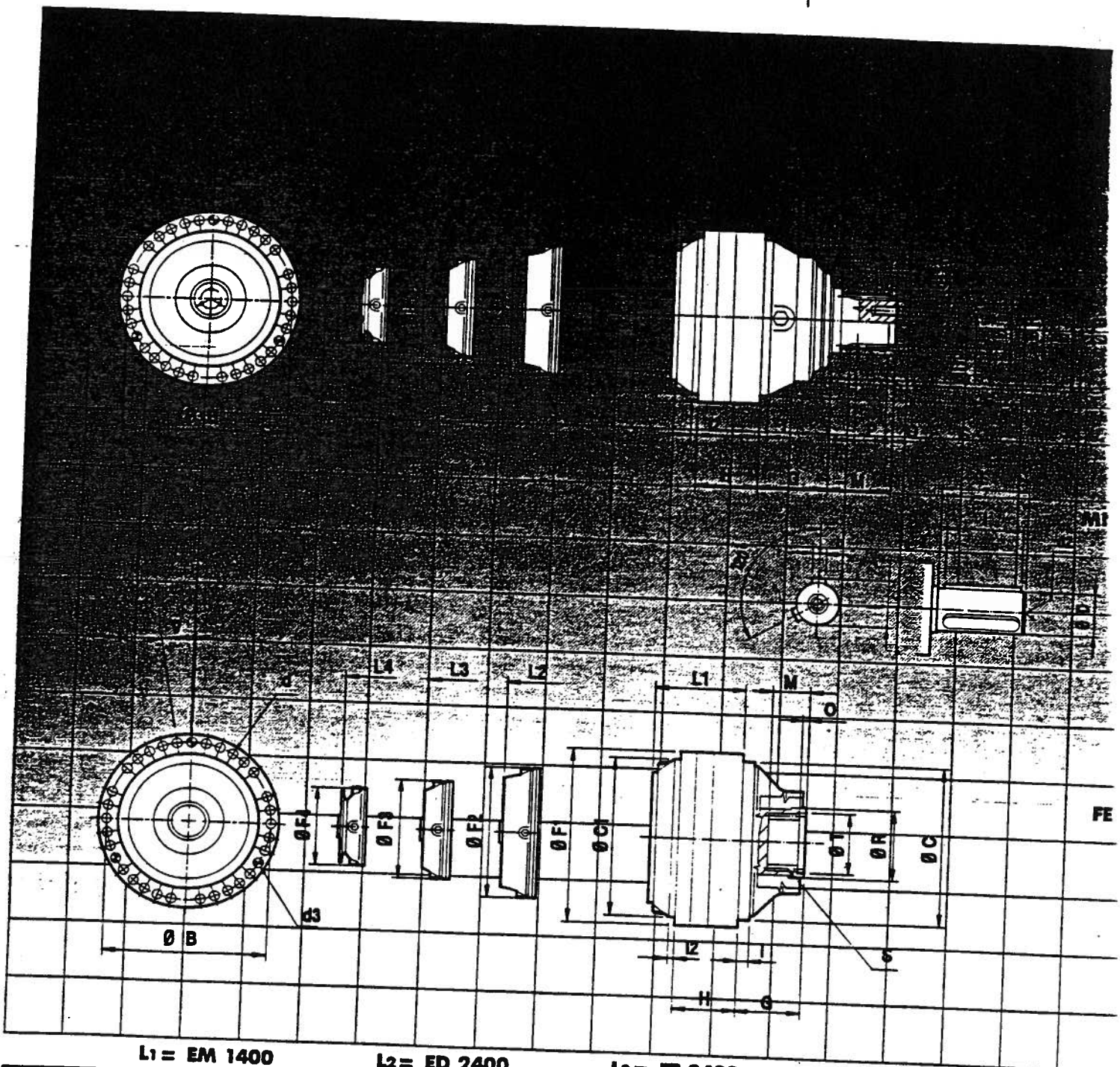
MAX TORQUE

GRAND. SIZE	010	020	030/045	040/046	065	090	150	250	400
T_{2max} (Nm)	1600	2800	5800	6000	10.000	15.000	20.000	35.000	50.000

TIPO	T_{2max}	$I_{eff.}$	n_{2max}
	400		
EM 1400	28500	4,08	250
	24500	5,05	200
	23000	5,81	200
ED 2400	28500	16,65	140
	28500	20,61	140
	24500	25,53	110
	24500	29,37	100
ET 3400	24500	34,98	100
	23000	40,24	90
	22000	43,95	80
	23000	50,56	70
	28500	58,26	40
	28500	68,66	40
	28500	83,00	50
	24500	89,35	30
	28500	99,87	40
	28500	106,51	35
	28500	123,70	35
	28500	142,30	30
	23000	165,90	20
	24500	185,10	25
	23000	202,70	20
	24500	227,10	18
	24500	253,60	18
	23000	291,70	15
	28500	301,00	12
	28500	349,60	12
	28500	412,00	10
	28500	444,40	9
	28500	516,30	8
	28500	550,30	7
	28500	623,50	7
	28500	724,10	6
	28500	772,10	5
	28500	896,90	5
	28500	1031,4	4
EQ 4400	28500	1083,0	4
	28500	1246,5	3,5
	24500	1341,8	3
	24500	1543,7	2,5
	24500	1838,6	2,5
	23000	2115,0	2
	23000	2310,7	2
	23000	2657,8	1,5

400

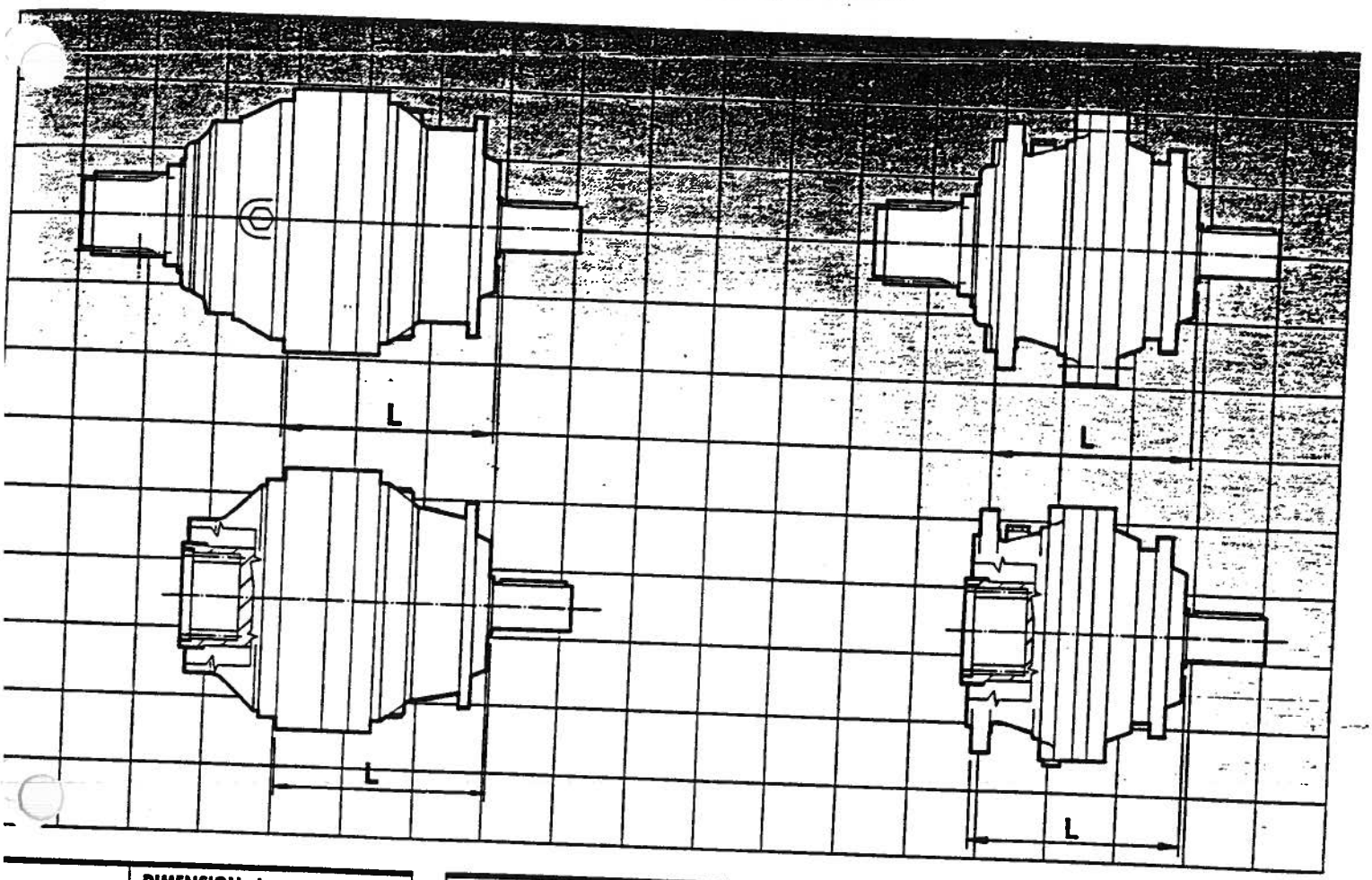
IN LINE REDUCTION GEARS



L1 = EM 1400 L2 = ED 2400 L3 = ET 3400 L4 = EQ 4400

	ØA	ØB	ØC	Ø C1	ØD	E	ØF1	ØF2	ØF3	ØF4	ØFc	Fc1	G	G1	H	I	I1	I2	L1	L2	L3
MN		400	370f7	370f7			430	355	240	240	268	268	117		125	16		16	231	332	399
MN1		400	370f7	370f7	120m6	210	430	355	240	240	268	268	117		125	16		16	231	332	399
FE		400	370f7	370f7			430	355	240	240	268	268	117		125	16		16	231	332	399
															125	16		16	231	332	399

GEARS WITH MALE INPUT SHAFT

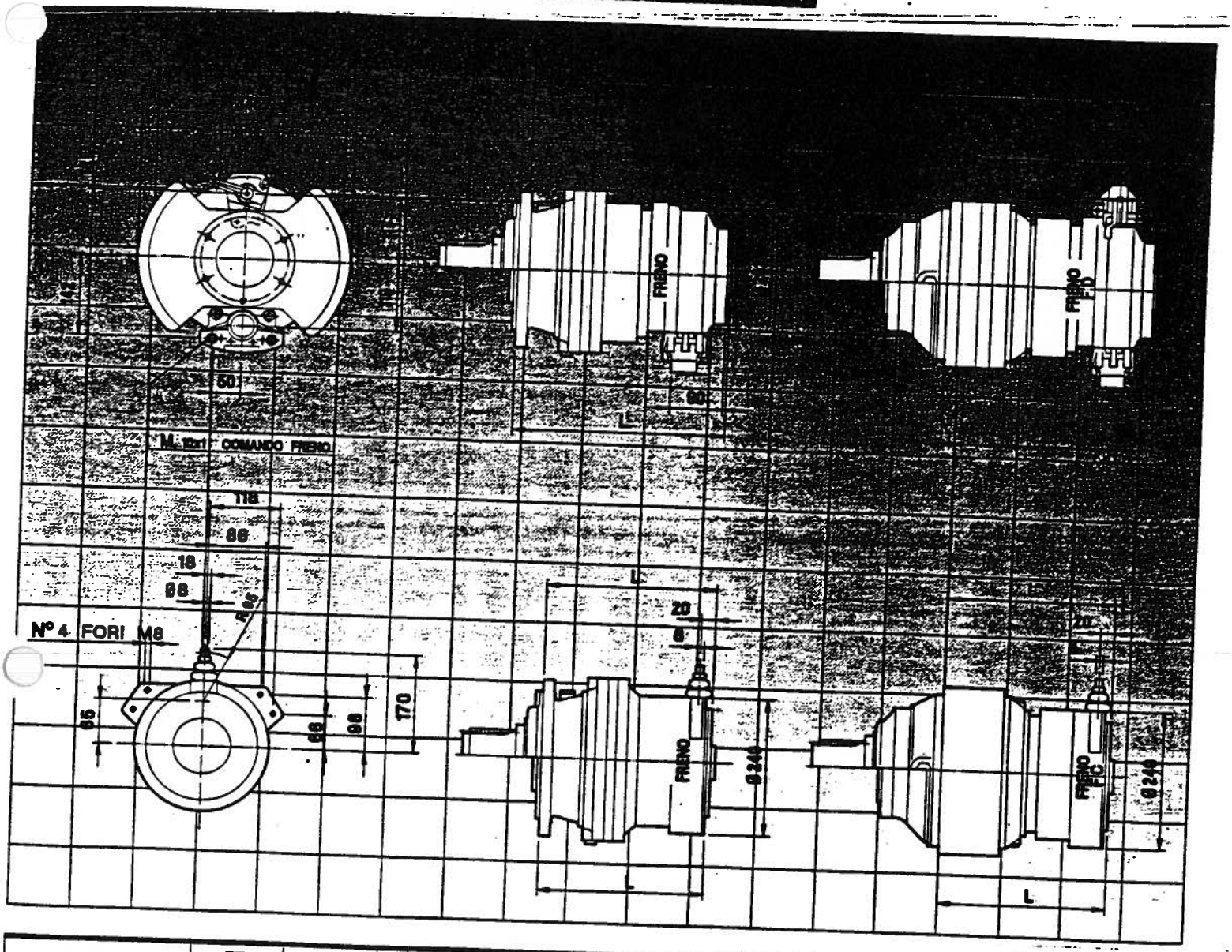


TYPE	DIMENSION L			
	S45 R	S46	S65	S90
M 1020 MR	255	296		
M 1020 FE	211	252	—	—
M 1045 MR	255	296		
M 1045 FE	211	252	—	—
M 1046 MN	272	313		
M 1065 MN	386	427	425	—
M 1065 FE	334	375	373	
M 1090 MN	371	412	—	—
M 1090 MR	410	451		
M 1090 FE	371	412	—	—
M 1150 MN	326	367	366	
M 1150 MR	346	387	386	—
M 1150 FE	306	347	346	
M 1250 MN	313	354	403	—
M 1250 FE	296	339	388	
M 1400 MN	—	—	—	426
M 1400 FE				426
M MR	323	364	—	—
M FE	278	319		

TIPO TYPE	DIMENSION L			
	S45 R	S46	S65	S90
EM 2046 MN	340	381		
ED 2065 MN	386	427	—	—
ED 2065 FE	334	375		
ED 2090 MN	371	412	—	—
ED 2090 MR	410	451		
ED 2090 FE	371	412	—	—
ED 2150 MN	326	367		
ED 2150 MR	346	387	—	—
ED 2150 FE	306	347		
ED 2250 MN	398	439	437	—
ED 2250 FE	383	424	422	
ED 2400 MN	462	503	501	—
ED 2400 FE	462	503	501	
ED 2600 MN	543	584	583	—
ED 2600 FE	544	585	584	
ED 2800 MN	570	611	660	—
ED 2800 FE	570	611	660	
ET 3090 MN	439	480	—	—
ET 3090 MR	477	518		

TIPO TYPE	DIMENSION L			
	S45 R	S46	S65	S90
ET 3090 FE	430	480		
ET 3150 MN	394	435	—	—
ET 3150 MR	414	455		
ET 3150 FE	374	415	—	—
ET 3250 MN	398	439		
ET 3250 FE	383	424	—	—
ET 3400 MN	462	503		
ET 3400 FE	462	503	—	—
ET 3600 MN	543	584		
ET 3600 FE	543	584	—	—
ET 3800 MN	655	696	694	
ET 3800 FE	655	696	694	—
EQ 4400 MN	530	571		
EQ 4400 FE	530	571	—	—
EQ 4600 MN	611	652		
ED 4600 FE	611	652	—	—
EQ 4800 MN	655	696		
EQ 4800 FE	655	696	—	—

IN-LINE REDUCTION GEARS WITH DISC OR SHOE BRAKE



TYPE	FD L	FC L
EM 1020/MR	290	271
EM 1020/FE	246	227
EM 1045/MR	290	271
EM 1045/FE	246	227
EM 1046/MN	308	288
EM 1065/MN	421	402
EM 1065/FE	369	350
ED 2045/MR	358	339
ED 2045/FE	313	294
ED 2046/MN	374	355
ED 2065/MN	421	402
ED 2065/FE	369	350
ED 2090/MN	406	387

TYPE	FD L	FC L
ED 2090/MR	344	325
ED 2090/FE	406	387
ED 2150/MN	381	362
ED 2150/MR	381	362
ED 2150/FE	343	324
ED 2250/MN	433	414
ED 2250/MR	433	414
ED 2250/FE	395	376
ET 3090/MN	474	455
ET 3090/MR	474	455
ET 3090/FE	474	455
ET 3150/MN	474	455
ET 3150/MR	448	429
ET 3150/FE	410	391

TYPE	FD L	FC L
ET 3250/MN	435	416
ET 3250/FE	418	399
ET 3400/MN	497	478
ET 3400/MR	497	478
ET 3400/FE	459	440
ET 3600/MN	578	559
ET 3600/MR	578	559
ET 3600/FE	540	521
ET 3800/MN	690	671
ET 3800/MR	690	671
ET 3800/FE	652	633
EQ 4400/MN	565	546
EQ 4400/MR	565	546
EQ 4400/FE	527	508
EQ 4600/MN	645	626
EQ 4600/MR	645	626
EQ 4600/FE	607	588

ORDERING CODE

1	2	3	4	5	6	7
E	D	2	045	MR	25	00

1 PLANETARY REDUCTION GEAR

2 STAGE

M = 1	STAGE	IN LINE
D = 2	STAGES	
T = 3	STAGES	
Q = 4	STAGES	
C =	RIGHT ANGLE	

3 NR. STAGES

4 REDUCTION GEAR SIZE

5 OUTPUT SIDE

MN =	SPLINED NORMAL SHAFT
MR =	SPLINED REINFORCED SHAFT
MN1 =	CYLINDRICAL NORMAL SHAFT
MR1 =	CYLINDRICAL REINFORCED SHAFT
FE =	SPLINED FEMALE

7 INPUT SIDE

00	=	UNIVERSAL
G.C.	=	MALE SUN PINION
S2/4F	=	SAE A 2/4 BOLTS
FL	=	MULTIDISC BRAKE
FDI	=	DISC BRAKE
FDM	=	MECHANIC DISC BRAKE
FDI/M	=	MECH. HYDRAULIC DISC BRAKE
FC	=	SHOE BRAKE
S45R S46 S65 S90	=	SPLINED MALE INPUT SHAFT
48·82 45·70	=	ALBERO MASCHIO PER RIDUTTORI ORTOGONALI MALE SHAFT ON RIGH ANGLE REDUCTION GEAR

6 NOMINAL REDUCTION RATIO

HYDRAULIC COMPONENT

REFERENCE DWG # 425-8001-01/8009-01

ITEM # PGT THROUGH PG-8

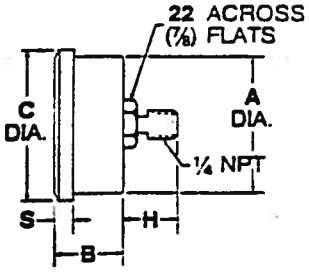
MANUFACTURER: ASHCROFT, 250 E. MAIN ST. STRATFORD, CT 06497 203-378-8281

DESCRIPTION: PRESSURE GAUGE

PART NUMBER: 63-1008SL-02B

Ordering Example Below: 63 1008S

Case Size		Tube / Socket Material	
Code		Code	
63	63mm (2½")	1008A	Bronze/Bra Soldered
100	100mm (4")		
63	63mm (2½")	1008S	AISI 316 Stainless Steel/AISI 3 Stainless Steel Welded
100	100mm (4")		



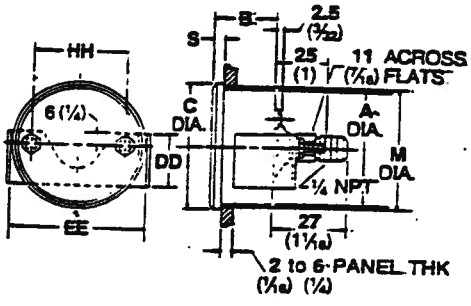
1008A BACK CONNECT

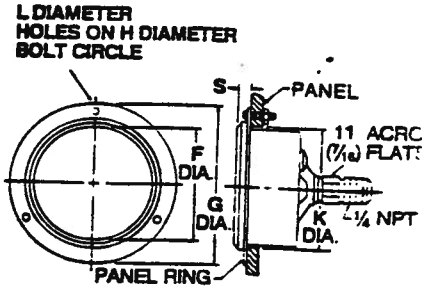
GAUGE SIZE		A	B	C	H	S
63 MM	MM	63	30	69	24	5.5
	INCH	2½	1 3/16	2 23/32	15/16	7/32
100 MM	MM	100	30	106	24	7
	INCH	3 15/16	1 3/16	4 3/32	15/16	9/32

DIMENSIONS IN ( ) ARE INCHES

Accuracy: 3-2-3%
ANSI Grade B

All gauges made in U.S.A.





1008 BACK CONNECT XUC VARIATION

GAUGE SIZE		A	B	C	DD	HH	M	S	EE
63 MM	MM	63	31	68	28	49	64	5.5	70
	INCH	2½	1 7/32	2 11/16	1⅛	1 15/16	2 17/32	7/32	2¾
100 MM	MM	100	32	105	28	76	101	7	103
	INCH	3 15/16	1 9/32	4 5/32	1 1/32	3	3 31/32	9/32	4 1/16

DIMENSIONS IN ( ) ARE INCHES

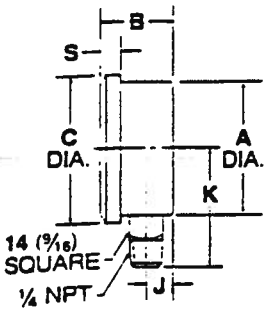
1008 BACK CONNECT W/PANEL RING

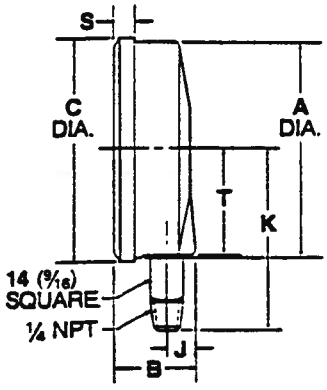
GAUGE SIZE		F	G	S	H	K	L
63 MM	MM	60	85	6	75	69	3.8
	INCH	2 11/32	3 5/16	1/4	2 15/16	2 23/32	15
100 MM	MM	97	132	6.3	116	102	4.6
	INCH	3 13/16	5 3/16	1/4	4 9/16	4	18

DIMENSIONS IN ( ) ARE INCHES

02 L. 0-1500#

Connection		Connection Location		Variations	
Code		Code		Code	
02	¼ NPT	L	Lower	XTU	Throttle Device 1008A or AL
02	¼ NPT	B	Back	XNH	Wired St. St. Tags
				XTS	Throttle device 1008S or SL
				XGV	Silicone Fluid
				XAN	100mm 1008S (L) only 1% Full Scale Accuracy
02	¼ NPT	L	Lower		
		B	Back		
02	¼ NPT	L	Lower		
04	½" NPT (lower only)	B	Back		

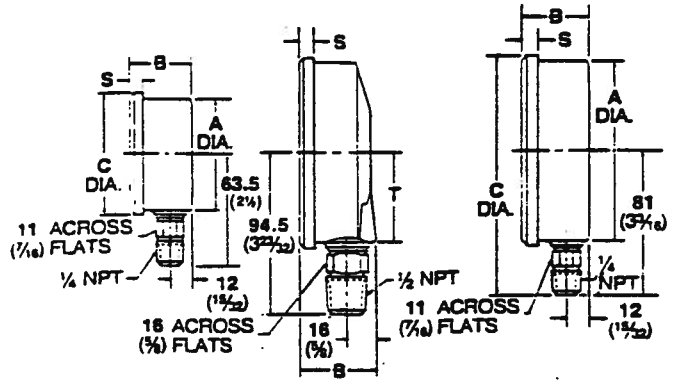




1008A LOWER CONNECT

GAUGE SIZE		A	B	C	J	K	S	T
63 MM	MM	63	31	69	10	55	5.5	—
	INCH	2½	1 7/32	2 23/32	13/32	2 3/32	¼	—
100 MM	MM	100	35	105.5	13.5	86	7	48.5
	INCH	3 15/16	1 3/8	4 5/32	17/32	3 3/8	9/32	1 29/32

DIMENSIONS IN ( ) ARE INCHES



1008S LOWER CONNECT

GAUGE SIZE		A	B	C	S	T
63 MM	MM	63	31	68	5.5	—
	INCH	2½	1 7/32	2 11/16	7/32	—
100 MM	MM	100	32.5	106	7	50
	INCH	3 15/16	1 9/32	4 5/32	9/32	1 31/32

DIMENSIONS IN ( ) ARE INCHES

Standard Ranges

Code	Single Scale Dial	Dual Scale Dial	
	psi	psi Inner Arc	kPa Outer Arc
A	0/15	0/15	0/100
AL	0/30	0/30	0/200
S	0/60	0/60	0/400
SL	0/100	0/100	0/700
	0/160	0/160	0/1100
	0/200	0/200	0/1400
	0/300	0/300	0/2000
	0/400	0/400	0/2800
	0/600	0/600	0/4000
	Vacuum in Hg.	In Hg.	In Hg.
	30/0	30/0	-100/0
	Compound in Hg./psi	In Hg./psi	kPa
	30/15	30/15	-100/100
	30/30	30/30	-100/200
	30/60	30/60	-100/400
	30/100	30/100	-100/700
	30/150	30/150	-100/1000
	30/300	30/300	-100/2000
	psi	psi Inner Arc	kPa Outer Arc
S	0/1000	0/1000	0/7000
SL	0/1500	0/1500	0/10000
	0/2000	0/2000	0/14000
	0/3000	0/3000	0/20000
	0/5000	0/5000	0/34000
	0/6000	0/6000	0/40000
	0/7500	0/7500	0/50000
	0/10000	0/10000	0/70000
	0/15000	0/15000	0/100000

Dual Scale Ammonia Ranges

	Compound in Hg./psi	0°F Outer Arc
S	30/150	-40/84°F
SL	30/300	-40/125°F

Weight in grams/ozs.

	63mm	100mm
Dry	112g/4 oz.	182g/6.5 oz. (¼ NPT) - 192g/6.9 oz. (½ NPT)
Liquid Fill	205g/7.5 oz.	434g/15 oz. (¼ NPT) 444g/16 oz. (½ NPT)

Accessories For Panel Mounting	Cat. No.
63mm "U" Clamp (for panel mounting)	3520
63mm Bezel Ring (for panel mounting)	3511F
100mm "U" Clamp (for panel mounting)	3521
100mm Bezel Ring (for panel mounting)	3513G
63mm Three Hole Front Mounting Flange	3516F
100mm Three Hole Front Mounting Flange	3517G
63mm Front Mounting Flange	3529

HYDRAULIC COMPONENT

REFERENCE DWG # 425-B001-01/B009-01

ITEM # — PSH-1

MANUFACTURER: BARKSDALE, 3211 FRUITLAND AVE LOS ANGELES, CA 90058-213-589-6181

DESCRIPTION: PRESSURE SWITCH

PART NUMBER: 9675-3

PRESSURE SWITCHES — All values given in P.S.I.

Proof (Test) Press.	Adjustable Range				Approx.* Actuation Value (Differential)	Catalog Number	IN STOCK
	Decreasing		Increasing				
	Min.	Max.	Min.	Max.			
3000	20	180	25	200	5 to 20	9675-0	
3000	75	505	85	540	10 to 35	9675-1	
7000	100	1400	130	1500	30 to 100	9675-2	
7000	235	3200	295	3400	60 to 200	9675-3	
12000	425	5640	545	6000	120 to 360	9675-4	
Approximate shipping weight lbs.						1.75	

HYDRAULIC COMPONENT

REFERENCE DWG # 424-8001-01 / 8009-01

ITEM # QD-2, QD-4, QD-5, QD-6, QD-10, QD-12

MANUFACTURER: STAUBLI

DESCRIPTION: QUICK DISCONNECT COUPLING

PART NUMBER: RBE08-7203/IA/3/HP
RBE08-7203/IA/9/HP
RBE06-7201/IA/6/HP
RBE06-2201/OD/IA/6/HP/FB/DK3
RBE11-7204/IA/6/HP
RBE11-7204/IA/1.5/HP

HYDRAULIC COMPONENT

REFERENCE DWG # 425-8001-01/8009-01

ITEM # QDT, QD3, QD9, QD11, QD13-4

MANUFACTURER: STAUBLI, PO BOX 189, DUNCAN, SC 29334 803-439-8180

DESCRIPTION: QUICK DISCONNECT COUPLING

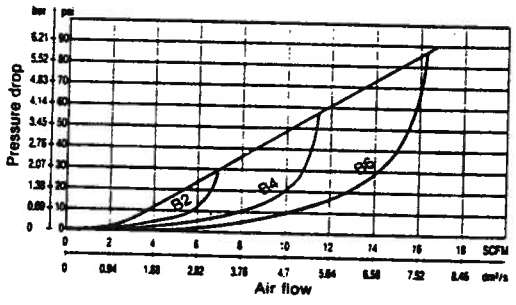
PART NUMBER: RBE08-2203/OD/IA/3/HP/FB/
RBE08-7203/IA/3/HP
RBE11-2204/OD/IA/6/HP/FB/D
RBE11-2204/OD/IA/1.5/HP/FB/D
RBE19-2205/OD/IA/3/HP/FB/D
RBE19-7205/OD/IA/3/HP
RBE19-2205/OD/IA/4.5/HP/FB/D
RBE19-7205/OD/IA/4.5/HP
RBE06-2201/OD/IA/1.5/HP/FB/
RBE06-7201/OD/IA/1.5/HP

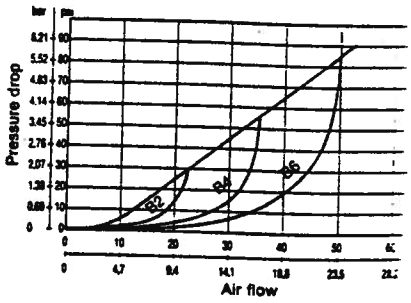
Ø nominal diameter (capacity) cross-section (sq. in.)	1/8"					1/4"				
	0,010					0,036				
RBE execution	STAND.	IA	IC	HP	W	STAND.	IA	IC	HP	W
working pressure PSI	725	725	217	5800	10^{-3} Torr	725	725	217	6530	10^{-3} Torr
Method of connection ■ under compressed air & gas with a force of 33 lbf	725 PSI					215 PSI				
■ under liquids with a force of 33 lbf	360 PSI					145 PSI				

Pneumatic charts flow rate/pressure drop from the single shut-off system

Direction of flow: socket → plug
Chart A with free flow rate

B 2 pressure 29 PSI
B 4 pressure 58 PSI
B 6 pressure 87 PSI

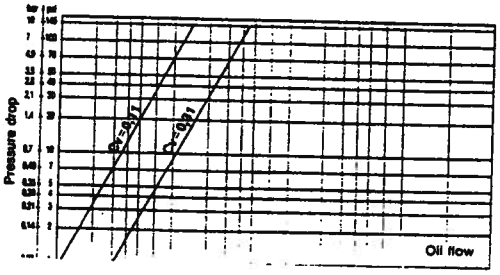


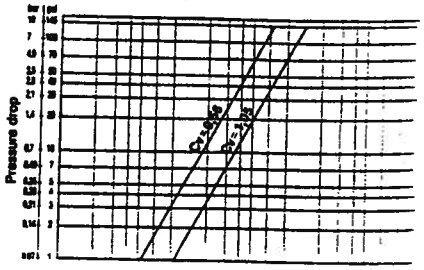


Hydraulic charts flow rate/pressure drop

1) chart of the double shut-off system (OD series)
Direction of flow: either
2) chart of the single shut-off system
Direction of flow: socket → plug

FJ 13 INVAROL OIL
according to US norm MIL - 5606 C Amd. 1
viscosity at 100°F : 78 Saybolt Universal Seconds
Trial temperature : 100°F

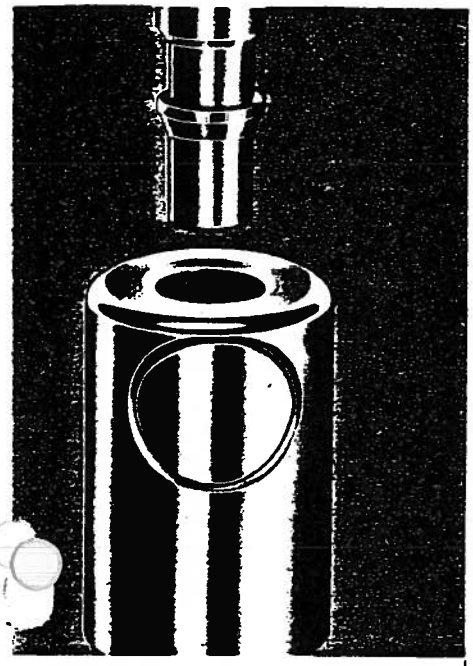




uid line quick-release couplings

pressure and flow rate

RBE 8



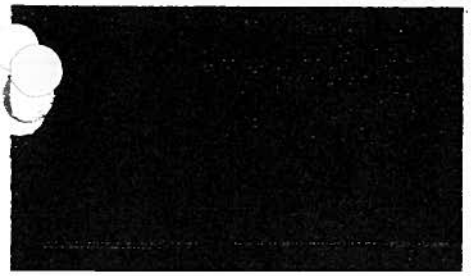
5/16"

0,077

ID.	IA	IC	HP	W
5	725	217	5800	10^{-3} Torr

145 PSI

100 PSI



RBE 11

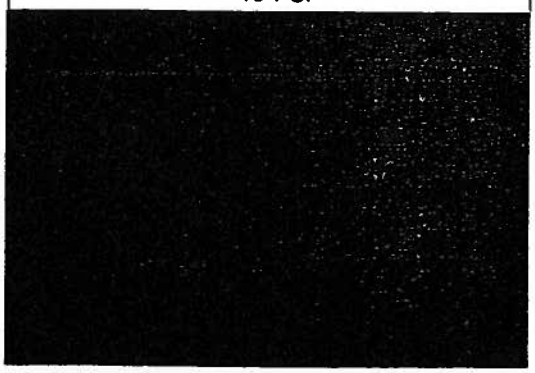
1/2"

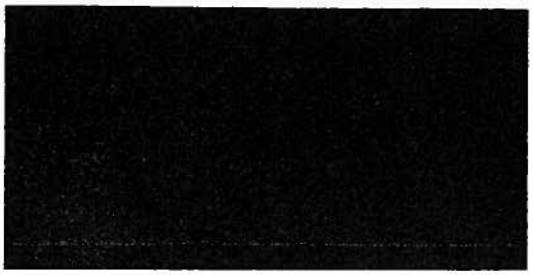
0,147

STAND.	IA	IC	HP	W
725	725	217	5080	10^{-3} Torr

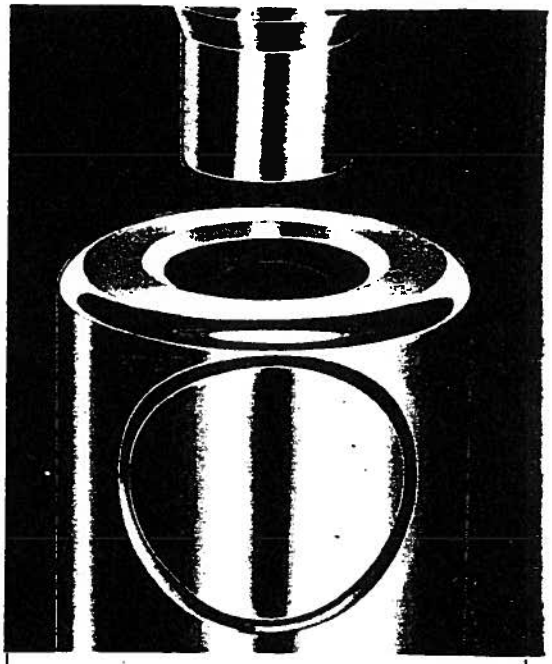
115 PSI

40 PSI





RBE 19



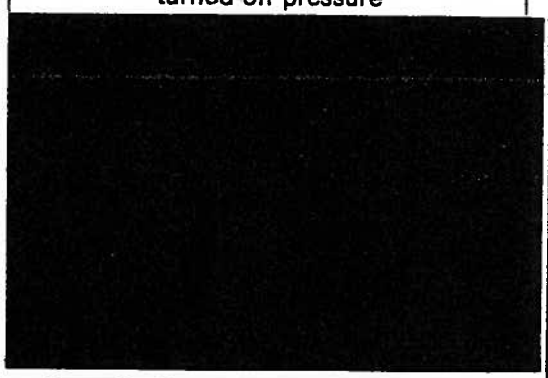
3/4"

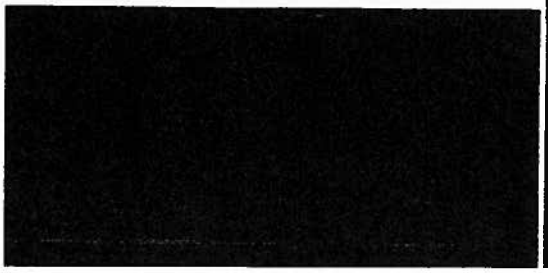
0,439

STAND.	IA	IC	HP	W
725	725	217	4350	10^{-3} Torr

55 PSI

turned off pressure





STÄUBLI Your choice o

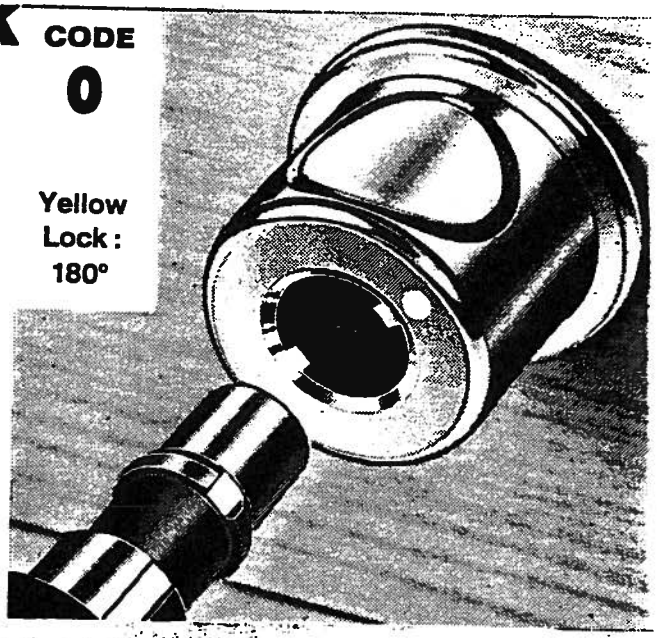
Add if necessar
Safety - keye

Safety-keyed quick -release couplings

CODE 0

7 safety keys

- to prevent all errors of connection, between :
  - ☐ different gases (risk of explosion)
  - ☐ different fluids
- to provide a color coded system for easy safety reference



■ Mechanical safety

The lock:
Plug with 2 grooves at a specified angle to each other.

The key:
Socket with 2 catches to correspond

7 possible combinations

■ Visual safety

Colored reference mark on the socket and on the plug.

A color anodized wheel-disc for built-in sockets.

High pressure quick-release couplings *HP Execution*

The automatic sockets and plugs are composed of particular components: bonded sleeve, valve, etc...

IA/HP SERIES
- High pressure hydraulic applications (see page 16 - Hydraulic fluids).
- Compressed air, high pressure gas – without any special corrosion proof requirement.

IC/HP SERIES
- Execution in stainless steel (AISI 316L) – Locking parts (push-button and plug body) are made of highly resistent stainless steel

Quick-release coupling IA/HP-IC/HP	RBE 3		RBE 6		RBE 8		RBE 11		RBE 19	
	working pressure	peak pressure	working pressure	peak pressure	working pressure	peak pressure	working pressure	peak pressure	working pressure	peak pressure
Working-pressure / PSI	5800	11600	6530	10150	5800	8700	5080	7250	4350	5800

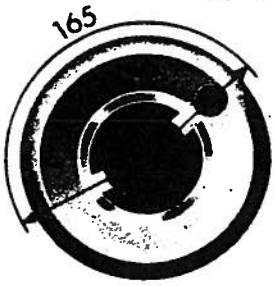
- Applications: similar to the IA/HP series ones but necessity to meet special requirements: corrosion proof – decontaminated.

The RBE quick-release couplings (HP series) shouldn't be used on hydraulic oil circuits with pulsatory normal operation or with oscillatory circuit. For this use, ask for our SBA/VB quick-release couplings

RBE quick-release couplings

one or more of these options : high pressure vacuum

CODE 1,5

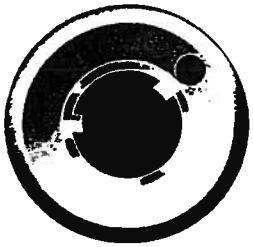


Violet
Lock :
165°

CODE 3

Red
Lock :
150°

CODE 4,5



Green
Lock :
135°

CODE 6

Blue
Lock :
120°

CODE 7,5

Brown
Lock :
105°

CODE 9

Black
Lock :
90°

Safety keys of the RBE quick-release couplings

	RBE 3							RBE 6							RBE 8							RBE 11							RBE 19						
CODE	0	1,5	3	4,5	6	7,5	9	0	1,5	3	4,5	6	7,5	9	0	1,5	3	4,5	6	7,5	9	0	1,5	3	4,5	6	7,5	9	0	1,5	3	4,5	6	7,5	9
Standard	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●		●	●	●	●	●	●		●	●		●	●	●		●
IA execution	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●		●	●	●	●	●	●		●	●		●	●	●		●
IC execution	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●		●	●	●	●	●	●		●	●		●	●	●		●

Vacuum quick-release couplings *W Execution*

- Quick-release couplings and plugs with automatic shut-off systems are designed with special components: seal support, valve reinforced springs.
- Vacuum tightness: up to 0,76 lusec.
- Test fluid: helium.
- For higher vacuum: please consult us.
- On request, we can carry out helium control tests on each unit.
- The IC series (Stainless Steel AISI 316L) automatically involves a W execution.

STÄUBLI

Note the part numbers of yo according to your ABCD c

1

OPTIONS

2 Other shut-off systems

PAGE 10

CODE

OD -OS

/OD/

3 Other materials

PAGE 11

CODE

IA -IC

/IA/

4 Safety keys

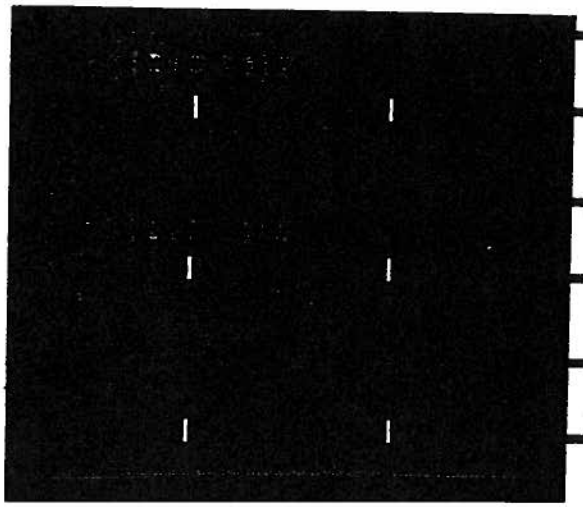
PAGES 12-13

CODE

0
1,5
3
4,5
6
7,5
9

/3/

Examples: complete part numb



	/IC/	/6/
	STAINLESS STEEL (AISI 316L)	SAFETY KEY 120° BLUE MARKING
	/IA/	
	STAINLESS STEEL 17% CHROMIUM	
/OD/	/IA/	/4,5/
DOUBLE SHUT-OFF SYSTEM	STAINLESS STEEL 17%	SAFETY KEY 105° BROWN MARKING

RBE options
ice

5
Designed for high pressure hard vacuum

PAGES 12-13

CODE

IA-HP
IC-HP
IA-W

/HP/

6
Other ring seals

PAGES 14-17

CODE

JC
JE
JN2
JS3
JT
JV

/JV/

7
Raised push-button safety push-button

PAGE 24

CODE

VD-VS

/VD/

8
Fixing device to attach the cap chain to the socket

PAGE 25

CODE

FB

/FB/

9
Colored wheel-disc on built-in socket

PAGE 21

CODE

D KJ
D KW
D KR
D KV
D KB
D KM
D KN

/D KJ/

with options

/VD/
RAISED PUSH-BUTTON

/W/ VACUUM
/JV/ JV SEAL

/HP/ HIGH PRESSURE
/JV/ JV SEAL
/VS/ SAFETY PUSH-BUTTON
/FB/ WITH FIXING DEVICE TO THE SOCKET

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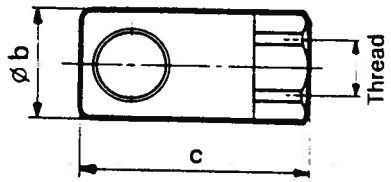
Part numbers for Standard quick-release couplings

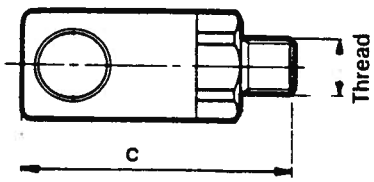
MODELS	RBE 3	RBE 6	RBE 8	RBE 11	RBE 1
CAPACITY	1/8"	1/4"	5/16"	1/2"	

1 Sockets, female thread



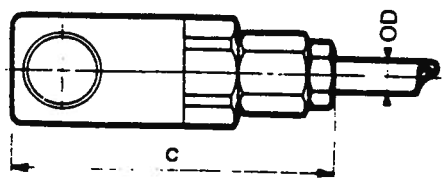
1/8"	FPT	RBE 03.1200	RBE 06.1200		
1/4"	FPT		RBE 06.1201	RBE 08.1201	
3/8"	FPT		RBE 06.1202	RBE 08.1202	RBE 11.1202
1/2"	FPT			RBE 08.1203	RBE 11.1203
3/4"	FPT				RBE 11.1204
1"	FPT				
b (in)		5/8	1 1/64	1 1/4	
c (in)		1 3/4	2 7/16	2 7/8	3

2 Sockets, male thread



1/8"	MPT	RBE 03.1250	RBE 06.1250		
1/4"	MPT	RBE 03.1251	RBE 06.1251	RBE 08.1251	
3/8"	MPT		RBE 06.1252	RBE 08.1252	RBE 11.1252
1/2"	MPT		RBE 06.1253	RBE 08.1253	RBE 11.1253
3/4"	MPT				RBE 11.1254
1"	MPT				
c (in)		1 5/16	2 1/2	3	3 3/4

3 Sockets for copper pipes



1/4"	O.D.	RBE 03.1733			
5/16"	O.D.	RBE 03.1734	RBE 06.1734		
3/8"	O.D.		RBE 06.1735	RBE 08.1735	
1/2"	O.D.			RBE 08.1736	
c (in)		2	3 1/8	3 7/16	

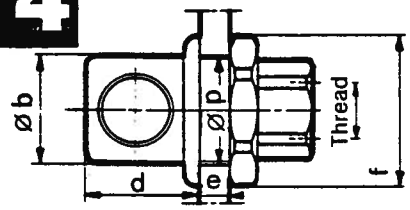
ID = internal diameter of the hose.
OD = outside diameter of the hose.

You can add to these part numbers your selected options according to our ABCD method (p. 18-19).

Pictured are the size dimensions of the standard models.
For more detailed measurements, do not hesitate to ask for our technical catalog.

MODELS	RBE 3	RBE 6	RBE 8	RBE 11
CAPACITY	1/8"	1/4"	5/16"	1/2"

4 Built-in sockets, female thread

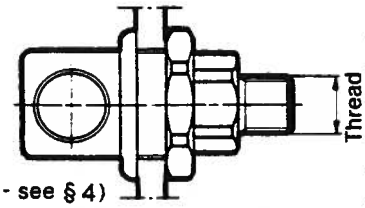


- aluminum wheel-disc
- add to our references, the following code for aluminum wheel-disc, color anodized:

COLOR	CODE
BLUE	D/KB
YELLOW	D/KJ
BROWN	D/KM
BLACK	D/KN
RED	D/KR
GREEN	D/KV
VIOLET	D/KW

1/8"	FPT	RBE 03.2200	RBE 06.2200		
1/4"	FPT		RBE 06.2201	RBE 08.2201	
3/8"	FPT		RBE 06.2202	RBE 08.2202	RBE 11.2202
1/2"	FPT		RBE 06.2203	RBE 08.2203	RBE 11.2203
3/4"	FPT				RBE 11.2204
1"	FPT				
b (in)		5/8	1 1/64	1 1/4	
d (in)		45/64	1 1/64	1 7/32	
e (in)		5/32	1/4	29/64	
f (in)		3/4	1 1/4	1 13/32	
p (in)		5/8	1 1/64	1 1/4	

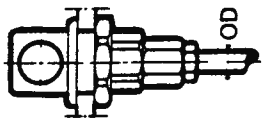
5 Built-in sockets, male thread



(wheel-disc - see § 4)

1/8"	MPT	RBE 03.2250	RBE 06.2250		
1/4"	MPT	RBE 03.2251	RBE 06.2251	RBE 08.2251	
3/8"	MPT		RBE 06.2252	RBE 08.2252	RBE 11.2252
1/2"	MPT		RBE 06.2253	RBE 08.2253	RBE 11.2253
3/4"	MPT				RBE 11.2254
1"	MPT				

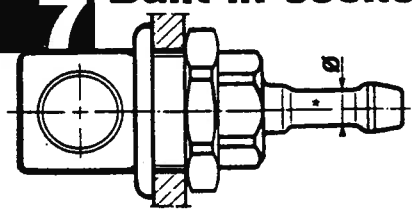
6 Built-in sockets for copper pipes



(wheel-disc - see § 4)

1/4"	O.D.	RBE 03.2733			
5/16"	O.D.	RBE 03.2734	RBE 06.2734		
3/8"	O.D.		RBE 06.2735	RBE 08.2735	
1/2"	O.D.			RBE 08.2736	

7 Built-in sockets for rubber hoses



* mounting with connecting- end (2 parts assembly) for the IC Series

1/4"	I.D.	RBE 03.2806	RBE 06.2806		
5/16"	I.D.		RBE 06.2808	RBE 08.2808	
3/8"	I.D.		RBE 06.2810	RBE 08.2810	
1/2"	I.D.		RBE 06.2813	RBE 08.2813	
5/8"	I.D.			RBE 08.2816	
3/4"	I.D.				

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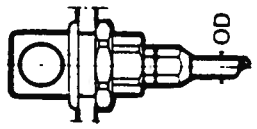
Part numbers for Standard quick-release couplings

MODELS	RBE 3	RBE 6	RBE 8	RBE 11
CAPACITY	1/8"	1/4"	5/16"	

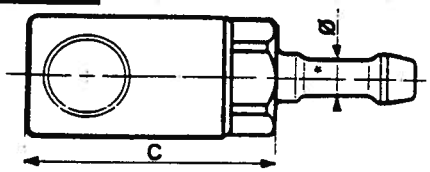
8 Built-in sockets for plastic tubing



(wheel-disc - see § 4)

1/4"	O.D.	RBE 03.2933		
5/16"	O.D.	RBE 03.2934	RBE 06.2934	
3/8"	O.D.		RBE 06.2935	RBE 08.2935
1/2"	O.D.			RBE 08.2936

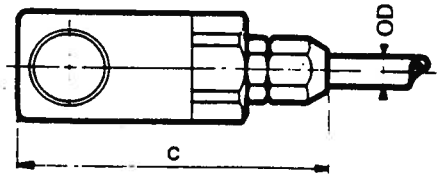
9 Sockets for rubber hoses



* mounting with connecting- end (2 parts assembly) for the IC Series

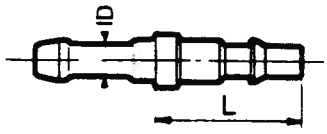
1/4"	I.D.	RBE 03.1806	RBE 06.1806	
5/16"	I.D.		RBE 06.1808	RBE 08.1808
3/8"	I.D.		RBE 06.1810	RBE 08.1810
1/2"	I.D.		RBE 06.1813	RBE 08.1813
5/8"	I.D.			RBE 08.1816
3/4"	I.D.			
1"	I.D.			
c (in)		1 3/8	1 7/8	2 5/16

10 Sockets for plastic tubing



1/4"	O.D.	RBE 03.1933		
5/16"	O.D.	RBE 03.1934	RBE 06.1934	
3/8"	O.D.		RBE 06.1935	RBE 08.1935
1/2"	O.D.			RBE 08.1936
c (in)		1 7/8	2 7/8	3 7/16

11 Plugs for rubber hoses



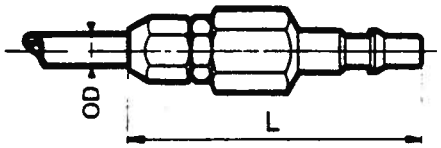
1/4"	I.D.	RBE 03.6806	RBE 06.6806	RBE 08.6806
5/16"	I.D.		RBE 06.6808	RBE 08.6808
3/8"	I.D.		RBE 06.6810	RBE 08.6810
1/2"	I.D.		RBE 06.6813	RBE 08.6813
5/8"	I.D.			RBE 08.6816
3/4"	I.D.			
1"	I.D.			
L (in)		1	1 3/8	

You can add to these part numbers your selected options according to our ABCD method (p. 18-19).

Pictured are the size dimensions of the standard models.
For more detailed measurements, do not hesitate to ask for our technical catalog.

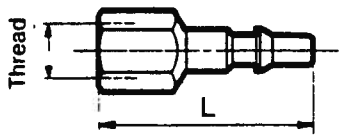
MODELS	RBE 3	RBE 6	RBE 8	RBE 11
CAPACITY	1/8"	1/4"	5/16"	1/2"

12 Plugs for plastic tubing



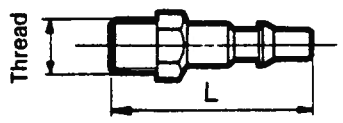
1/4" O.D.	RBE 03.6933			
5/16" O.D.	RBE 03.6934	RBE 06.6934		
3/8" O.D.		RBE 06.6935	RBE 08.6935	
1/2" O.D.			RBE 08.6936	
L (in)	2 3/16	2 3/4	3 1/4	

13 Plugs, female thread



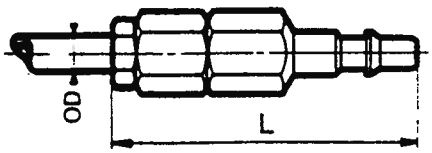
1/8" FPT	RBE 03.6200	RBE 06.6200		
1/4" FPT		RBE 06.6201	RBE 08.6201	
3/8" FPT		RBE 06.6202	RBE 08.6202	
9/16" x 20 UN		RBE 06.6315		
1/2" FPT			RBE 08.6203	
3/4" FPT				
1" FPT				
L (in)	1 3/8	2 1/16	2 7/16	

14 Plugs, male thread



1/8" MPT	RBE 03.6250	RBE 06.6250		
1/4" MPT	RBE 03.6251	RBE 06.6251	RBE 08.6251	
3/8" MPT		RBE 06.6252	RBE 08.6252	
1/2" MPT			RBE 08.6253	
3/4" MPT				
1" MPT				
L (in)	1 7/8	2	2 9/16	

15 Plugs for copper pipes



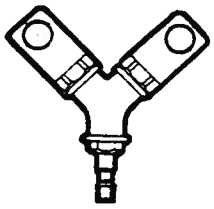
1/4" O.D.	RBE 03.6733			
5/16" O.D.	RBE 03.6734	RBE 06.6734		
3/8" O.D.		RBE 06.6735	RBE 08.6735	
1/2" O.D.			RBE 08.6738	
L (in)	2	2 7/8		

STÄUBLI

Part numbers for Standard quick-release couplings

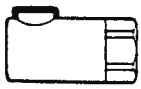
MODELS	RBE 3	RBE 6	RBE 8	RBE 1
CAPACITY	1/8"	1/4"	5/16"	1/2"

16 Movable Y sockets



RBE 03.8600	RBE 06.8600	RBE 08.8600	RBE 11.8600	RBE 19.860C

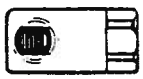
17 Raised push-button



- designed to make frequent connections and disconnections and for works with safety gloves.

■ **Add the VD code to part numbers of the quick-release couplings.**

18 Safety push-button

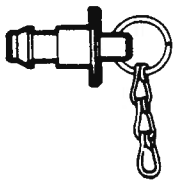


To disconnect:
1) release safety device
2) press the button (not available on RBE 3 quick-release coupling)
- When working with compressed air this device is only required for high-security purposes.

■ **Add the VS code to part numbers of the quick-release couplings.**

19 Anti-dust cap to be fixed to sockets

Supplied with nickeled chain, 6 inches long.



RBE 03.8500	RBE 06.8500	RBE 08.8500	RBE 11.8500	RBE 19.8500

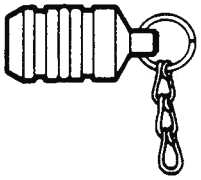
You can add to these part numbers your selected options according to our ABCD method (p. 18-19).

Pictured are the size dimensions of the standard models.
For more detailed measurements of the different models, do not hesitate to ask for our technical catalog.

MODELS	RBE 3	RBE 6	RBE 8	RBE 11	RBE [illegible]
CAPACITY	1/8"	1/4"	5/16"	1/2"	[illegible]

20 Anti-dust cap to be fixed to plugs

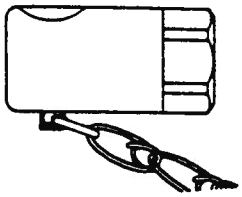
Supplied with nickeled chain, 6 inches long.



RBE 03.8550	RBE 06.8550	RBE 08.8550	RBE 11.8550	RBE [illegible]

21 Fixing device to attach the cap chain to the socket

■ **Add the FB code to part numbers of the quick-release couplings.**

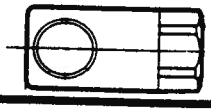


STÄUBLI Pa ers

for Standard quick-release couplings + OD execution

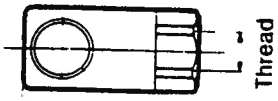
MODELS	RBE 3	RBE 6	RBE 8	RBE 11	RBE [illegible]
CAPACITY	1/8"	1/4"	5/16"	1/2"	

1 OD execution quick-release couplings



■ Add the OD code to the part number of the quick-release couplings with single shut-off systems.
Part numbers have been given on previous pages.

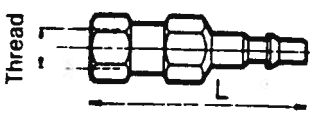
2 Sockets for hydraulic pipes



■ Add the OD code to the part number.

1/8" FPT	RBE 03.1200			
1/4" FPT		RBE 06.1201		
3/8" FPT			RBE 08.1202	
1/2" FPT				RBE 11.1203
1" FPT				
7/16"-20 SAE	RBE 03.1390			
9/16"-18 SAE		RBE 06.1391		
3/4"-16 SAE			RBE 08.1392	
7/8"-14 SAE				RBE 11.139[illegible]
1"5/16-12 SAE				

3 Plugs with automatic shut-off valve



Female thread

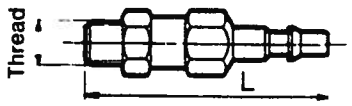
1/8" FPT	RBE 03.7200	RBE 06.7200		
1/4" FPT		RBE 06.7201	RBE 08.7201	
3/8" FPT		RBE 06.7202	RBE 08.7202	RBE 11.720[illegible]
1/2" FPT			RBE 08.7203	RBE 11.720[illegible]
3/4" FPT				RBE 11.720[illegible]
1" FPT				
L (in)	2	2⅞	3⅝	

You can add to these part numbers your selected options according to our ABCD method (p. 18-19).

Pictured are the size dimensions of the standard models.
For more detailed measurements of the different models, do not hesitate to ask for our technical catalog.

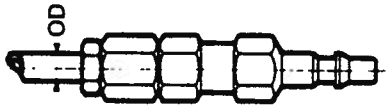
MODELS	RBE 3	RBE 6	RBE 8	RBE 11	RBE [illegible]
CAPACITY	1/8"	1/4"	5/16"	1/2"	[illegible]

4 Plugs with automatic shut-off valve, male thread



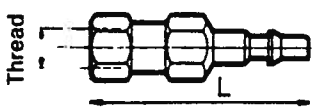
Male thread				
1/8" MPT	RBE 03.7250	RBE 06.7250		
1/4" MPT	RBE 03.7251	RBE 06.7251	RBE 08.7251	
3/8" MPT		RBE 06.7252	RBE 08.7252	RBE 11.7252
1/2" MPT			RBE 08.7253	RBE 11.7253
3/4" MPT				RBE 11.7254
1" MPT				
L (in)	2 1/4	3 1/16	3 9/16	

5 Plugs with automatic shut-off valve for copper pipes



1/4" OD	RBE 03.7733			
5/16" OD	RBE 03.7734	RBE 06.7734		
3/8" OD		RBE 06.7735	RBE 08.7735	
1/2" OD			RBE 08.7736	

6 Plugs with automatic shut-off valve for hydraulic pipes

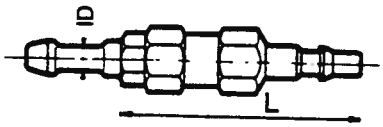


1/8" FPT	RBE 03.7200			
1/4" FPT		RBE 06.7201		
3/8" FPT			RBE 08.7202	
1/2" FPT				RBE 11.7203
1" FPT				
7/16"20 SAE	RBE 03.7390			
9/16"-18 SAE		RBE 06.7391		
3/4"-16 SAE			RBE 08.7392	
7/8"-14 SAE				
1"5/16-12 SAE				
L (in)	2 1/4	2 7/8	3 3/4	

STÄUBLI Part numbers for Standard quick-release couplings + OD execution

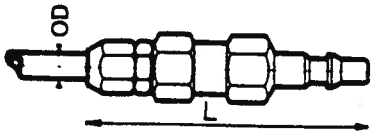
MODELS	RBE 3	RBE 6	RBE 8	RBE 11
CAPACITY	1/8"	1/4"	5/16"	1/2"

7 Plugs with automatic shut-off valve for rubber hoses



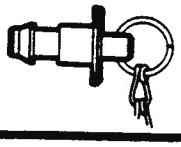
1/4" I.D.	RBE 03.7806	RBE 06.7806		
5/16" I.D.		RBE 06.7808	RBE 08.7808	
3/8" I.D.		RBE 06.7810	RBE 08.7810	
1/2" I.D.		RBE 06.7813	RBE 08.7813	RBE 11.7813
3/4" I.D.				RBE 11.7819
1" I.D.				
L (in)	1¾	3¼	3⅝	

8 Plugs with automatic shut-off valve for plastic tubing



1/4" O.D.	RBE 03.7933			
5/16" O.D.	RBE 03.7934	RBE 06.7934		
3/8" O.D.		RBE 06.7935	RBE 08.7935	
1/2" O.D.			RBE 08.7936	

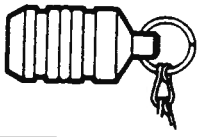
9 Anti-dust cap to be fixed to sockets



Supplied with nickeled chain, 6 inches long.

	RBE 03.8500	RBE 06.8500	RBE 08.8500	RBE 11.8500

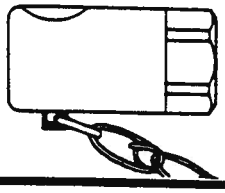
10 Anti-dust cap to be fixed to plugs



Supplied with nickeled chain, 6 inches long.

	RBE 03.8550	RBE 06.8550	RBE 08.8550	RBE 11.8550

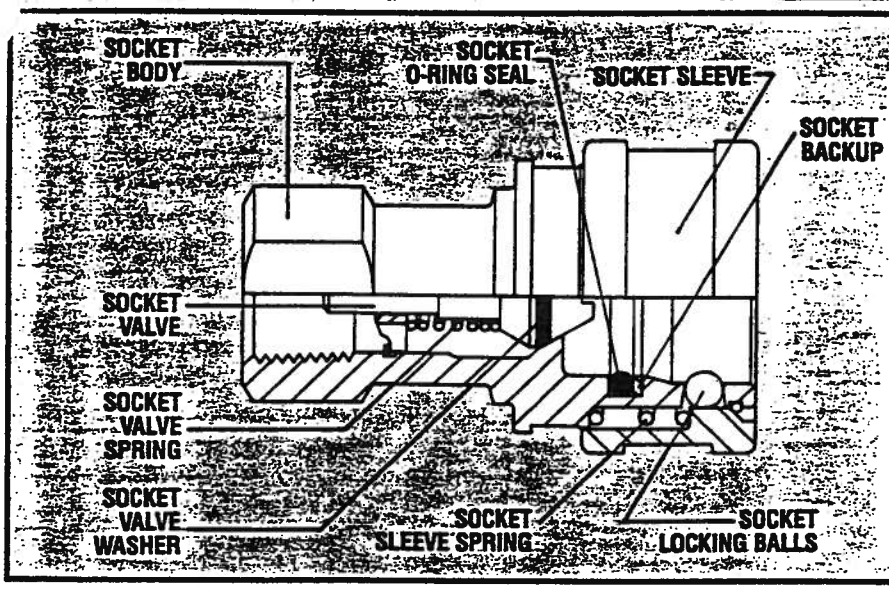
11 Fixing device to attach the cap chain to the socket



■ **Add the FB code to the part numbers of the quick-release couplings.**

The above components are identical to those of the S 10 - 20 - 21

HANSEN SERIES 1-HK to 8-HK



HYDRAULIC COMPONENT

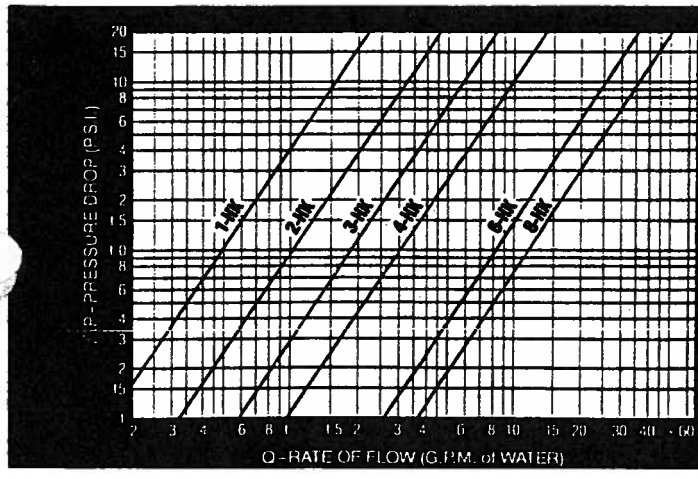
REFERENCE DWG # 425-8001-01/8009-01
(QD-8, 424-8001-01/8009-01)
ITEM # QD-7, QD-19, QD-20
MANUFACTURER: HANSEN, 4050 W. 150TH ST. CLEVELAND, OHIO 44135 216-252-3850
DESCRIPTION: QUICK DISCONNECT COUPLING (QD-8) LL4K26 w/PPDC-4-HK
PART NUMBER: LL4-H26 w/PPDC-4HK
LL6-H31w/PPDC-6HK
LL6-K31w/PSDC-6HK

The pipe threaded HK type coupling is intended for general fluid systems where two-way quick shut-off is needed upon disconnect as in industrial hydraulics, water and chemical handling applications. The Series HK in brass with a -192 seal can be used for steam applications (100 psi saturated steam 338°F). Spring loaded valves in each coupling half — socket and plug — seal immediately upon disconnect. The main advantages of these type valves are that they need little or no lubrication, present a relatively low pressure drop, are field serviceable and lightweight.

Brass sockets are sometimes used in liquid systems, and utilize 2 socket O-ring seals for positive shut-off when connecting or disconnecting.

SPECIFICATIONS

PART DESCRIPTION	STANDARD MATERIAL	OPTION – MATERIAL – PART NO.
Socket Body	Steel, Brass, Stainless Steel	
Socket Sleeve	Steel, Brass, Stainless Steel	Sleeve Lock (-SL)
Socket Sleeve Spring	Stainless Steel	
Socket Valve	Steel	Brass, Stainless Steel
Socket Valve Spring	Stainless Steel	
Socket Valve Washer	BunaN	Teflon (-115), Neoprene (-118), Viton (-143), BunaN (-146), EPDM (-192)
Socket Locking Balls	Stainless Steel	
Socket Backup Ring	Teflon	
Plug Body	Steel, Brass, Stainless Steel	
Plug Valve	Steel	Brass, Stainless Steel
Plug Valve Washer	BunaN	Teflon (-115), Neoprene (-118), Viton (-143), BunaN (-146), EPDM (-192)
Plug Valve Spring	Stainless Steel	
ACCESSORIES		
Socket		Dust Cap (See Page 19)
Plug		Dust Cap (See Page 19)



Pressure Ratings (psi)

Series	STEEL (Standard) Service	STEEL (High Pressure) Service	BRASS Service	STAINLESS STEEL Service
1-HK	4,000	—	3,000	5,000
2-HK	3,700	3,700	2,700	3,700
PP2-HK	50 (+35° to 150°F)			
3-HK	3,700	3,700	2,200	3,700
4-HK	3,700	4,500	2,200	4,200
6-HK	2,000	3,700	2,000	3,000
8-HK	1,500	3,500	1,500	2,500

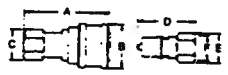
HANSEN SERIES 1-HK to 8-HK

Series 1-HK

Part No.	Material	Connection	Dimensions A	B	C
1-H11	Steel	⅛" FPT	1.91	0.98	0.69
B1-H11	Brass				
UL1-H11†	Brass				
LL1-H11	SS 303				
ML1-H11	SS 316				

Female End Connections

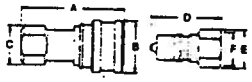
SOCKET PLUG



Part No.	Material	Connection	Dimensions D	E	F
1-K11	Steel	⅛"FPT	1.26	0.65	0.56
B1-K11	Brass				
UL1-K11†	Brass				
LL1-K11	SS 303				
ML1-K11	SS 316				

Series 2-HK

2-H16	Steel	¼" FPT	2.26	1.17	0.88
2-H16C	HPS				
B2-H16	Brass				
UL2-H16†	Brass				
LL2-H16	SS 303				
ML2-H16	SS 316				



2-K16	Steel	¼" FPT	1.52	0.87	0.75
2-K16C	HPS				
B2-K16	Brass				
UL2-K16†	Brass				
LL2-K16	SS 303				
ML2-K16	SS 316				

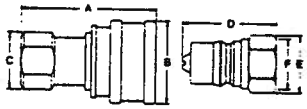
Series 3-HK

3-H21	Steel	⅜" FPT	2.56	1.42	1.00
3-H21C	HPS				
B3-H21	Brass				
UL3-H21†	Brass				
LL3-H21	SS 303				
ML3-H21	SS 316				

3-K21	Steel	⅜" FPT	1.76	1.01	0.88
3-K21C	HPS				
B3-K21	Brass				
UL3-K21†	Brass				
LL3-K21	SS 303				
ML3-K21	SS 316				

Series 4-HK

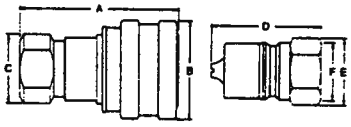
4-H26	Steel	½" FPT	2.96	1.86	1.28
4-H26C	HPS				
B4-H26	Brass				
LL4-H26	SS 303				
ML4-H26	SS 316				



4-K26	Steel	½" FPT	2.03	1.30	1.13
4-K26C	HPS				
B4-K26	Brass				
LL4-K26	SS 303				
ML4-K26	SS 316				

Series 6-HK

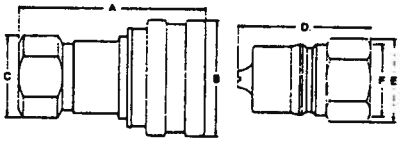
6-H31	Steel	¾" FPT	3.48	2.22	1.56
6-H31C	HPS				
B6-H31	Brass				
LL6-H31	SS 303				
ML6-H31	SS 316				



6-K31	Steel	¾" FPT	2.36	1.52	1.31
6-K31C	HPS	¾" FPT	2.36	1.52	1.38
B6-K31	Brass	¾" FPT	2.36	1.52	1.31
LL6-K31	SS 303				
ML6-K31	SS 316				

Series 8-HK

8-H36	Steel	1" FPT	4.13	2.61	1.86
8-H36C	HPS				
B8-H36	Brass				
LL8-H36	SS 303				
ML8-H36	SS 316				



8-K36	Steel	1" FPT	2.85	1.88	1.63
8-K36C	HPS				
B8-K36	Brass				
LL8-K36	SS 303				
ML8-K36	SS 316				

HPS = High Pressure, Steel B = Diameter C & F = Across Flats E = Across Corners HPS = High Pressure, Steel

†UL LISTED for use at the fuel container of LP-Gas fueled industrial lift trucks or tractors employing removable fuel containers. Uses — 146 seal material and stainless steel valve assembly.

British Parallel Pipe Thread

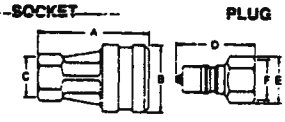
Series I-HK to 8-HK available with British Parallel Pipe Thread. Contact a Hansen Distributor.

Series P2-HK Plastic Socket & Plug

Part No.	Female Connection	Dimensions A	B	C
PP2-H-25F	¼" FPT	2.38	1.45	0.88

Female End Connections

SOCKET PLUG



Part No.	Female Connection	Dimensions D	E	F
PP2-K-25F	¼" FPT	1.65	1.01	0.88

B = Diameter C & F = Across Flats E = Across Corners

Any Plug and Socket from the same Series, regardless of

HANSEN INDUSTRY INTERCHANGE Two-Way Shut-Off

about industry interchanges... This interchange of Hansen part numbers to other makers of quick-connective couplings is intended to show where it is possible to connect two different manufacturers' parts together so that they will effect a seal and work properly in a fluid system. However, Hansen cannot quarantee the quality, workmanship, dimensions or tolerances of the other manufacturers' parts, even though they might be interchangeable. Therefore, whenever mixing non-Hansen parts, even though our guide indicates they are interchangeable, the final assembly must always be tested before being put into service. Failure to test could result in a sudden failure of the coupling causing severe personal injury or death.

Female Pipe Sockets and Plugs with BunaN Seals

	Female End Connections	HANSEN[1] Series HK	AEROQUIP[2] Steel	AEROQUIP[2] Brass	AEROQUIP[2] Stainless	FASTER Series H	FOSTER Series HK	NITTO
SOCKETS	⅛" FPT	1-H-11	FD45-1003-0202	FD45-1101-0202	FD45-1005-0202	HNV18NPT-FS	H1S	1S
	¼" FPT	2-H-16	FD45-1003-0404	FD45-1101-0404	FD45-1005-0404	HNV14NPT-FS	H2S	2S
	⅜" FPT	3-H-21	FD45-1003-0606	FD45-1101-0606	FD45-1005-0606	HNV38NPT-FS	H3S	3S
	½" FPT	4-H-26	FD45-1003-1212	FD45-1101-0808	FD45-1005-0808	HNV12NPT-FS	H4S	4S
	¾" FPT	6-H-31	FD45-1003-1616	FD45-1101-1212	FD45-1005-1212	HNV34NPT-FS	H6S	6S
	1" FPT	8-H-36	—	FD45-1101-1616	FD45-1005-1616	HNV1NPT-FS	H8S	8S
	1¼" FPT	10-H-41	—	—	—	—	—	10S
	1¼" FPT	12-H-41	—	—	—	—	—	—
	1½" FPT	12-H-46	—	—	—	—	—	12S
	2" FPT	20-H-51	—	—	—	—	—	16S
	2½" FPT	20-H-56	—	—	—	—	—	—
	3" FPT	20-H-61	—	—	—	—	—	—
PLUGS	⅛" FPT	1-K-11	FD45-1002-0202	FD45-1086-0202	FD45-1004-0202	HNV18NPT-MS	K1S	1P
	¼" FPT	2-K-16	FD45-1002-0404	FD45-1086-0404	FD45-1004-0404	HNV14NPT-MS	K2S	2P
	⅜" FPT	3-K-21	FD45-1002-0606	FD45-1086-0606	FD45-1004-0606	HNV38NPT-MS	K3S	3P
	½" FPT	4-K-26	FD45-1002-1212	FD45-1086-0808	FD45-1004-0808	HNV12NPT-MS	K4S	4P
	¾" FPT	6-K-31	FD45-1002-1616	FD45-1086-1212	FD45-1004-1212	HNV34NPT-MS	K6S	6P
	1" FPT	8-K-36	—	FD45-1086-1616	FD45-1004-1616	HNV1NPT-MS	K8S	8P
	1¼" FPT	10-K-41	—	—	—	—	—	10P
	1¼" FPT	12-K-41	—	—	—	—	—	—
	1½" FPT	12-K-46	—	—	—	—	—	12P
	2" FPT	20-K-51	—	—	—	—	—	16P
	2½" FPT	20-K-56	—	—	—	—	—	—
	3" FPT	20-K-61	—	—	—	—	—	—

	Female End Connections	HANSEN[1] Series HK	OBAC Brass	PARKER[3] Steel	PARKER[3] Brass	PARKER[3] Stainless	SAFEWAY[4] Series S100	SNAPTITE[5] Series H	SNAPTITE-72 Series 72
SOCKETS	⅛" FPT	1-H-11	HK2712B-M	H162	BH160	SH162	—	VHC42	—
	¼" FPT	2-H-16	HK2722D-M	H262	BH260	SH262	S105-2	VHC44	72C-4-4-F
	⅜" FPT	3-H-21	HK2732F-M	H362	BH360	SH362	S105-3	VHC66	72C-6-6-F
	½" FPT	4-H-26	HK2742G-M	H462	BH460	SH462	S105-4	VHC88	72C-8-8-F
	¾" FPT	6-H-31	HK2752H-M	H662	BH660	SH662	S105-6	VHC1212	72C-12-12-F
	1" FPT	8-H-36	—	H862	BH860	SH862	S105-8	VHC1616	72C-16-16-F
	1¼" FPT	10-H-41	—	—	—	—	—	—	—
	1¼" FPT	12-H-41	—	H1262L	BH1260L	SH1260L	—	VHC2020	—
	1½" FPT	12-H-46	—	H1262N	BH1260N	SH1260N	—	VHC2424	—
	2" FPT	20-H-51	—	—	—	—	—	VHC3232	—
	2½" FPT	20-H-56	—	—	—	—	—	VHC4040	—
	3" FPT	20-H-61	—	—	—	—	—	VHC4848	—
PLUGS	⅛" FPT	1-K-11	HN2712B-M	H163	BH161	SH163	—	VHN42	—
	¼" FPT	2-K-16	HN2722D-M	H263	BH261	SH263	S101-2	VHN44	72N-4-4-F
	⅜" FPT	3-K-21	HN2732F-M	H363	BH361	SH363	S101-3	VHN66	72N-6-6-F
	½" FPT	4-K-26	HN2742G-M	H463	BH461	SH463	S101-4	VHN88	72N-8-8-F
	¾" FPT	6-K-31	HN2752H-M	H663	BH661	SH663	S101-6	VHN1212	72N-12-12-F
	1" FPT	8-K-36	—	H863	BH861	SH863	S101-8	VHN1616	72N-16-16-F
	1¼" FPT	10-K-41	—	—	—	—	—	—	—
	1¼" FPT	12-K-41	—	H1263L	BH1261L	SH1263L	—	VHN2020	—
	1½" FPT	12-K-46	—	H1263N	BH1261N	SH1263N	—	VHN2424	—
	2" FPT	20-K-51	—	—	—	—	—	VHN3232	—
	2½" FPT	20-K-56	—	—	—	—	—	VHN4040	—
	3" FPT	20-K-61	—	—	—	—	—	VHN4848	—

SAE Thread Sockets & Plugs

Female End Connections	HANSEN[1] Series HK	FOSTER Series HK	PARKER[3] Series 60
SOCKETS			
7/16"–20 FT	1-H-4	H1S4	H162-T4
9/16"–18 FT	2-H-6	H2S6	H262-T6
¾"–16 FT	3-H-8	H3S8	H362-T8
⅞"–14 FT	4-H-10	H4S10	H462-T10
1"–12 FT	6-H-12	H6S12	H662-T12
1 5/16"–12 FT	8-H-16	H8S16	H862-T16
PLUGS			
7/16"–20 FT	1-K-4	K1S4	H163-T4
9/16"–18 FT	2-K-6	K2S6	H263-T6
¾"–16 FT	3-K-8	K3S8	H363-T8
⅞"–14 FT	4-K-10	K4S10	H463-T10
1 1/16"–12 FT	6-K-12	K6S12	H663-T12
1 5/16"–12 FT	8-K-16	K8S16	H863-T16

Footnotes

[1] HANSEN OPTIONS: For Socket or Plug to be: Brass Prefix: B
SS-303 LL
SS-316 ML

[2] AEROQUIP SEAL OPTIONS: Base Number Changes:

Seal Material	Steel Plug	Steel Socket	Brass Plug	Brass Socket	Stainless Plug	Stainless Socket
Viton	1071	1070	1092	1091	1078	1076
EP	1064	1065	1153	1156	1121	1122

Example: FD45-1002-0202 changes to FD45-1071-0202 for Viton

[3] PARKER OPTIONS: For Seals to be: EP Suffix: W
Viton Y
Neoprene Z

[4] SAFEWAY OPTIONS: For Socket or Plug to be: Brass Prefix: B
Stainless SS

[5] SNAPTITE Series H is not interchangeable with

Dust Caps

Dust Caps are available where protection is necessary against excessive flying grit or dust. The Socket Dust Cap is easily applied by pulling back Sleeve of Socket and inserting Dust Cap. The Plug Dust Cap covers the entire machined surface of the Plug. It is applied and held in place by friction on locking portion of the Plug. Metal dust caps are supplied with chain and attachment ring. Plastic dust caps have integral plastic strap and attachment loop.

SERIES	Socket Dust Cap		Plug Dust Cap	
	METAL	PLASTIC	METAL	PLASTIC
1-HK	SDC-1-HK	P-SDC-1-HK	PDC-1-HK	P-PDC-1-HK
2-HK	SDC-2-HK	P-SDC-2-HK	PDC-2-HK	P-PDC-2-HK
3-HK	SDC-3-HK	P-SDC-3-HK	PDC-3-HK	P-PDC-3-HK
4-HK	SDC-4-HK	P-SDC-4-HK	PDC-4-HK	P-PDC-4-HK
8000	SDC-4-HK	P-SDC-4-HK	PDC-8000	—
6-HK	SDC-6-HK	P-SDC-6-HK	PDC-6-HK	P-PDC-6-HK
8-HK	SDC-8-HK	P-SDC-8-HK	PDC-8-HK	P-PDC-8-HK
10-HK	—	—	—	—
12-HK	SDC-12-HK	—	PDC-12-HK	—
20-HK	SDC-20-HK	—	PDC-20-HK	—
6-FF	—	P-SDC-6FF	—	P-PDC-6FF

For Dust Caps not listed here . . . contact your Hansen Distributor.

Pressure Ratings**

Since application conditions vary so widely, the pressures listed are intended as a guide only and not a guarantee of performance. Pressure peaks and extreme surge flows may cause a coupling to become inoperative.

SERVICE PRESSURE: **Service pressure is the "rated pressure" as defined by ANSI/B93.2-1971, as "the qualified operating pressures which are recommeded for a component or a system by the manufacturer."**

**NOTE!
Pressure ratings listed were determined by testing threaded Sockets and Plugs. Sockets and Plugs with hose stem and hose clamp end connections are designed and recommended for use with shop air line pressure only (150 PSIG max.) when used with the appropriate style hose.

Flow Capacities

C_V FACTOR: The quantity of 60°F water, in GPM, which will flow through a Coupling with a pressure drop (△P) of 1 psi.

To find pressure drop:

$$\triangle P = \left(\frac{GPM}{C_V}\right)^2$$

A_C NUMBER: The amount of air, in SCFM, which will flow through a Coupling with an inlet pressure of 100 psig and a pressure drop (△P) of 5 psi.

⚠ WARNING

Couplings do wear out — in order to avoid severe bodily injury or death, couplings must be routinely checked for condition and replaced, if necessary.

WARRANTY

Every effort has been made to have all illustrations and drawings accurately represent the product as it actually was at the time this catalog was printed.

Obviously, however, so that we may effectively continue to meet the requirements of users, changes in some items may be made during the life of this catalog — which, on occasion, may be made without notice.

"All Hansen Coupling Division Products are guaranteed. for a period of 90 days from the date of shipment to a customer, to be free of defects in material and workmanship. Any claimed defect must be reported to the Hansen Coupling Division in writing within the warranty period. This warranty is limited to replacing or repairing, at the Company's option, f.o.b. the Company's factory, any part which upon Company inspection is found to be defective. Components purchased by the Company from others are warranted only to the extent of the guarantee or warranty, if any, made to the Company. THE ABOVE WARRANTY COMPRISES THE COMPANY'S SOLE AND ENTIRE WARRANTY OBLIGATION AND LIABILITY IN CONNECTION WITH TUTHILL CORPORATION HANSEN COUPLING DIVISION PRODUCTS. ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY EXCLUDED. THE COMPANY IN NO EVENT SHALL BE LIABLE FOR INDIRECT OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE SALE OR USE OF HANSEN COUPLING DIVISION PRODUCTS."

HYDRAULIC COMPONENT

REFERENCE DWG #424-B001-01/B009-01

ITEM # SOV-2

MANUFACTURER: DELTA

DESCRIPTION: SOLENOID OPERATED VALVE

PART NUMBER: DFS3A00HC12S

HYDRAULIC COMPONENT

REFERENCE DWG #425-B001-01/B009-01

ITEM # SOV-1

MANUFACTURER: DELTA, 4484 BOEING DRIVE ROCKFORD, IL 61109 815-397-6628

DESCRIPTION: SOLENOID OPERATED VALVE

PART NUMBER: DFS3A00HC12S

SPECIFICATIONS

Nominal Flow	Per Table #1
Max. Operating Pressure	3000 PSI (207 bar)
Max. Internal Leakage	5 in³/m, 82 ml/m
Response time (average at full rated conditions)	30 mil-sec to 45 mil-sec.
Viscosity Range	36 SSU (3CSC) to 3000 SSU (647CSC)
Filtration	30 micron nominal
Media Operating Temp. Range	-35F (-37.2C) to 200F (93.3C)
Seals	Buna-N O-rings, Standard
Mounting Position	No Restriction
Cavity Form Tool No.	40500001
Options	See Option Data
Electrical Data	See Coil Data
Valve Body Data	See Body Data
Weight	4.40 oz. (.125 kg)
Design	Direct Acting Spool Valve
Operating Fluid Media	All General Purpose Hydraulic Fluid
Cartridge torque requirements	30 Ft. Lbs. at 3000 psi
Coil Nut torque requirements	15 In. Lbs. to 45 In. Lbs.

WHEN ORDERING FILL IN ALL BOXES

ORDERING INFORMATION

DF-S3A- [**] [*****] [*]

1 2 3 4 5

1: BASIC MODEL NO.	2: OPTIONS	3: COIL TERMINATION	4: VOLTAGE	5: BODY
		***** = WITHOUT COIL		* = WITHOUT BODY
7/8 - 14 Tha. 3 way, 2 Position, Spool Valve	00 -Buna Standard V0 -Viton Standard 0M-Buna, Override, Detent VM-Viton, Override, Detent B1 -Buna, Override Nondetent V1 -Viton, Override Nondetent	DL -Double Lead * SL -Single Lead DS -Double Spade * SS -Single Spade DP -Double Post SP -Single Post HC -Hirschmann * CL -Conduit Lead * * NOTE BELOW	06 -6VDC 12 -12VDC 24 -24VDC 36 -36VDC 48 -48VDC 25 -24VAC 11 -120VAC 22 -220VAC 44 -440VAC	N =1/4' NPT S =#6 SAE

* ONLY THESE COIL TERMINATIONS ARE STOCK.

APPROXIMATE COIL ASSEMBLY WEIGHT: .72 lbs./.32 kg.

HYDRAULIC COMPONENT

REFERENCE DWG # 425-8001-01/8009-01

ITEM # STR-1, STR-2, STR-3

MANUFACTURER: FLOW EZY, PO BOX 1749 ANN ARBOR, MI 48106 313-665-8777

DESCRIPTION: STRAINER - SUMP TYPE

PART NUMBER: SO - 1 1/2 - 200
SO - 1 1/2 - 100

ALL-METAL CONSTRUCTION

These sump strainers have aluminum end caps and fittings, with stainless steel, pleated elements in mesh sizes 30 to 200. Continuous epoxy-bonded joints will not leak, and the units may be cleaned and used indefinitely.

HOW TO ORDER Select the desired specifications from the ordering table, and build an ordering code number, as shown in this example:

Example: 75 – 2-1/2 – NIPPLE – 100 – RV-3
GPM – NPT – (spell out NIPPLE, if wanted) – MESH – VALVE (omit, if not wanted)

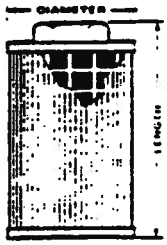
ORDERING TABLE

STYLES	GPM (Flow Capacity)	NPT (Pipe size)	CONNECTION (Nut or Nipple)	MESH (Screen Size)	VALVE (Optional)
All-Metal Construction	5	3/4	Nut only	30 (.022")	RV-3 (3-psi bypass)
	5	1			
	10	1		60 (.010")	
	20	1-1/4			
	30	1-1/2			RV-5 (5-psi bypass)
	50	1-1/2 & 2		100 (.005")	
	75	2-1/2	Nut or Nipple	200 (.0029")	*
	100	3			

(Pressure drop through a clean element will not exceed .2 psi (.4-in Hg) at rated flow of 150 SSU viscosity fluid.)

NUT STYLE

GPM RATING	SCREEN AREA (Sq. inches)	NPT (Pipe Size)	OVERALL DIMENSIONS Diameter	Length
5	62	3/4	3-1/16	3-1/16
10	125	1	3-1/16	5-5/16
20	162	1-1/4	3-1/16	7-1/8
30	310	1-1/2	4	8-3/4
50	340	1-1/2 & 2	4	9-5/8
75	400	2-1/2	5-1/16	12-5/8
100	500	3	5-1/16	12-5/8



DAMPENERS

TYPE CODE
(also ordering example)

SB 330 P-10 A 1/112 S - 210 C 010

Series
SB = Bladder type
SBO = Diaphragm type

Special design
A = Shock Absorber (Surge Kushon)
P = Pulsation Dampener
PH = Pulsation Dampener / High Flow
PS = PASAFE CBD Pulsation Dampener
S = Suction Stabilizer

Size (see table)

Line connection
A = Threaded
E = Threaded (for SBO welded design only)
F = Flanged (see table)

Gas port
For series SB
1 = Standard FPS-connection (BV1-1S04570)
For series SBO
1 = Standard FPK-connection (M28x1,5)
2 = Non rechargeable
4 = Standard FPS-connection (BV1-1S04570)
6 = Standard FPK-connection (M28x1,5/ for SBO threaded design only)

Material code
Depending on application
112 = Standard for oil service (mineral oil)

Fluid port
1 = Carbon steel
2 = Stainless steel (420 / water service)
3 = Stainless steel (316)
6 = Low temperature carbon steel (< -20°F)

Shell
0 = Polyurethane coated (internal / water service)
1 = Carbon steel
2 = Electroless nickel plated (internal / water service)
4 = Stainless steel (316)
6 = Low temperature carbon steel (< -20°F)

Bladder/ diaphragm compound
2 = NBR (Buna N)
3 = ECO (Hydrin)
4 = IIR (Butyl)
5 = NBR (Low temperature Buna N)
6 = FPM (Viton)
7 = Others

Country of installation
S = USA
S1 = Canada
Others on request

Max. working pressure
(see table)
210 = 3000 PSI

Connection thread
A = BSP (ISO 228)
C = SAE (ANSI B1.1)

Precharge pressure (p0) in bar [1]

1) Not all combinations available
1) Only required for E2-model

1991	Date	Name	Rev.				
Drawn	13.06.	Lamberti	Date				
Checked	13.06.	Leichner	Name				
			Rev. No.				

Sheet 1 of

Part-no.
03 000 996 4: 02050043

HYDAC CORPORATION
Bethlehem, PA 18017
TELEPHONE : (215) 264-9503
TELEFAX : (215) 264-9519

530 SERIES CALIPER DISC BRAKE

MODEL NUMBERS

Brake Fluid	Hydraulic Oil
02-530-131	02-530-126
03-530-131	03-530-126

HYDRAULIC COMPONENT

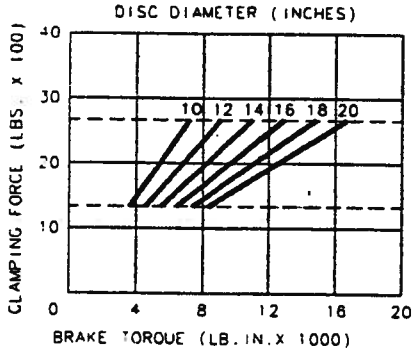
REFERENCE DWG #424-8001-01/8002-01

ITEM # BK-1, BK-2

MANUFACTURER: MICO, 1911 LEE BLVD. NORTH MANKATO, MN 507-625-1426 56002-2118

DESCRIPTION: BRAKE - CALIPER TYPE

PART NUMBER: 03-530-126



NOTE: DISC RUBBING SPEED SHOULD NOT EXCEED 5000 FT. / MIN.

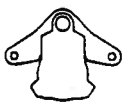
SPECIFICATIONS

- **Disc range:** 9" to unlimited
- **Disc thickness:** .500"
- **Total lining contact area:** 7.82 $in.^2$
- **Continuous duty pressure:** 1500 psi
- **Intermittent duty pressure:** 2500 psi
- **Volume for complete retraction:** 0.5 $in.^3$
- **Caliper material:** ductile iron
- **Caliper finish:** zinc chromate yellow
- **Lining thickness:** .37"
- **Usable lining thickness:** .28"
- **Lining material is non-asbestos**
- **Porting:** No. 4 SAE o-ring boss
- **Approximate weight:** 15 lbs.

MOUNTING STYLES

02-530-126
02-530-131

03-530-126
03-530-131



(See page 16 for dimensions.)

TORQUE FORMULA (Bt is Brake Torque)

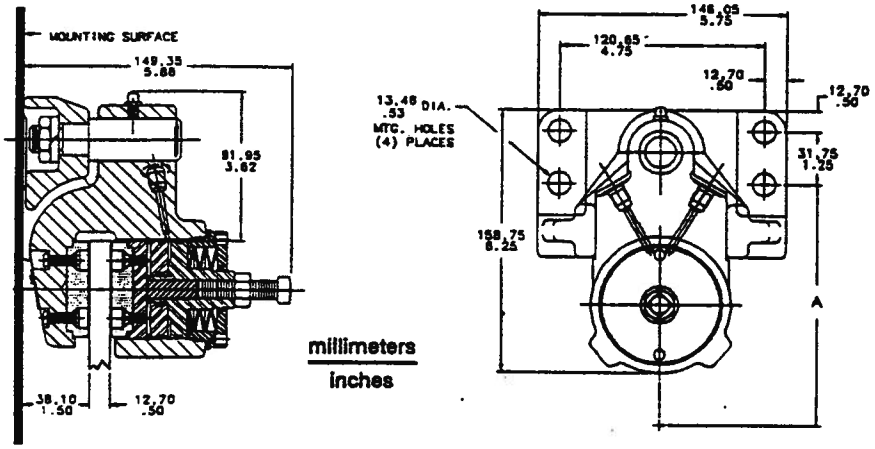
Bt(new) = 1890 X (DISC RAD. – 1.18)

Bt(worn) = 910 X (DISC RAD. – 1.18)

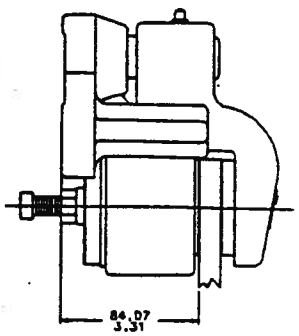
Complete Retraction Pressure: 1000 psi

MODEL 02-530-131 SHOWN

NOTE: Mounting Bolts Not Included



REVERSED POSITION



RECTANGULAR MOUNT

"A" dimension = DISC RAD. + $\frac{41.15}{1.62}$ (For 9" to 15" Dia. Discs)

"A" dimension = DISC RAD. + $\frac{44.45}{1.75}$ (For greater than 15" to unlimited Dia. Discs)

TRIANGULAR MOUNT

"A" dimension = DISC RAD. + $\frac{3.05}{0.12}$

HYDRAULIC COMPONENT

REFERENCE DWG # 424-8001-01 / 8007-01

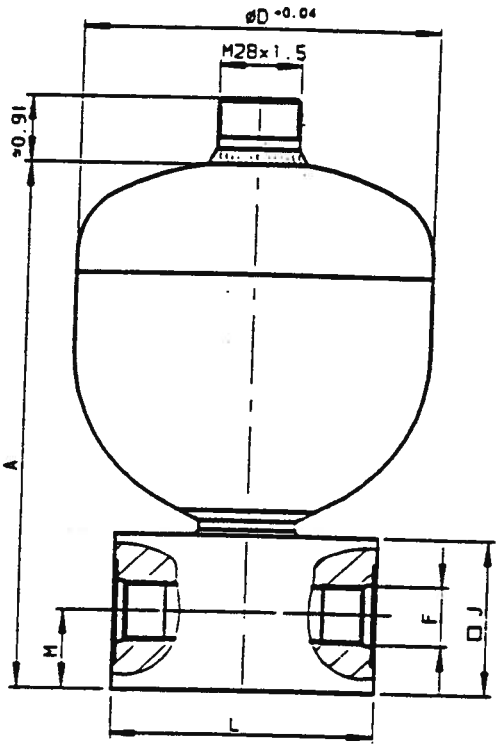
ITEM # ACC-1

MANUFACTURER: HYDAC, 2280 CITY LINE ROAD BETHLEHEM, PA 18017 215-266-0500

DESCRIPTION: ACCUMULATOR - DIAPHRAGM TYPE

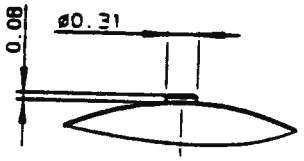
PART NUMBER: SB210-.32E4/1125-210 CK

VERSION E1



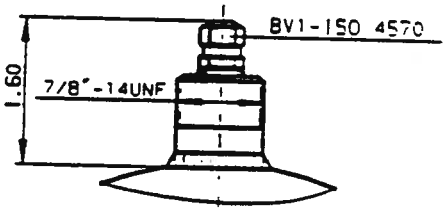
VERSION E2

(Up to size 1)

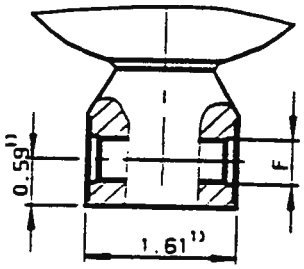


VERSION E4

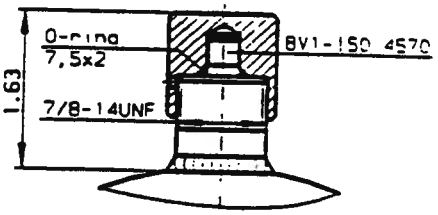
(Up to size 0.75)



Size 0.075 and 0.16



(Size 1 to 3.5)



1) For SAE-Threads only
2) Pressure loss at Q (viscosity 32 cSt) approx. 50 PSI

Series	Size	Gas Volume cu. in	max. working pressure PSI	BAR	Weight (Lbs)	A (in)	øD (in)	Thread F SAE	Thread F BSP	□J (in)	L (in)	M (in)	Q 2) (GPM)
SBO 250	0.075	5	3600	250	2.2	4.57	2.52	9/16-18UNF	ISO 228-G1/4	-	-	-	5
SBO 210	0.16	10	3000	210	2.5	5.04	2.91						
SBO 210	0.32	20			5.8	5.96	3.66	3/4-16UNF	ISO 228-G1/2	1.97	3.15	0.99	10
SBO 160	0.5	30	2400	160	8.7	6.51	4.13						
SBO 330	0.6	36	4700	330	12.3	7.74	4.53						
SBO 210	0.75	45	3000	210	11.2	7.58	4.76						
SBO 200	1	60	3000	210	12.9	8.02	5.35	1 5/16-12UNF	ISO 228-G 1	2.36	4.13	1.18	40
SBO 210	2	120	3000	210	19.6	9.47	6.57						
SBO 250	3.5	230			29.3	13.96	6.70						

1991	Date	Name	Rev.	a	b			Sheet 1 of 1
Drawn	18.12.	LAMBERTI	Date	07.01.92	09.12.92			
Checked	18.12.	LEICHNER	Name	LAMBERTI	LAMBERTI			Part-no.

HYDRAULIC COMPONENT

REFERENCE DWG #424-B001-01 / B007-01

ITEM # CYL-1

MANUFACTURER: MARTNER, 1995 AUCUTT Rd. MONTGOMERY, ILL 60538 708-897-4111

DESCRIPTION: _____

PART NUMBER: _____

INSTALLATION DIMENSIONS

STOCK MODEL NO.	BORE SIZE	STROKE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W	X
SMC-1504	1½	4	7	½	1 5/16	1½	1½	¼	½	½	0	½	2½	2½	1 13/16	¼	3½	¼	1½	1 5/16	11/16	11/16	1¼	1¼-20

HYDRAULIC COMPONENT

REFERENCE DWG #424-8001-01/8007-01

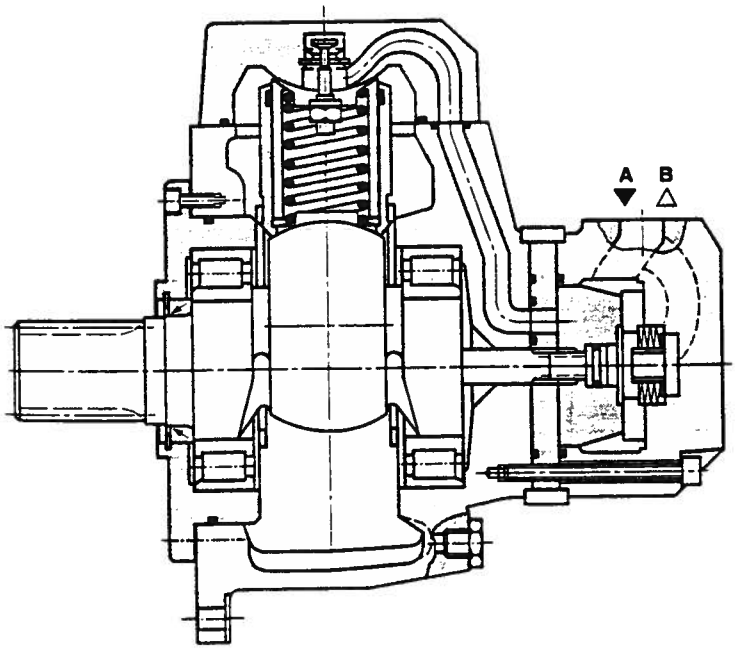
ITEM # HM-1

MANUFACTURER: REXROTH. 2315 CITY LINE ROAD BETHLEHEM, PA 18017 215-694-8300

DESCRIPTION: HYDRAULIC MOTOR - BIDIRECTIONAL TYPE

PART NUMBER: MR 450 P3/F

MR/MRE



- MR – 3625 PSI (250 bar) operating pressure
- MRE – 3050 PSI (210 bar) operating pressure
- Housing with separate cylinder covers
- Line connections in adaptor plates – SAE- flange or pipe thread

Ordering Code: MRP; MR; MRE

			X		X	/			*

Motor Model

MRP	= MRP
MR	= MR
MRE	= MRE

Displacement– Size

Motor Model MRP

12.14 in³/rev (199 cm³/rev) =	Size 200= 200
15.19 in³/rev (249 cm³/rev) =	Size 250= 250
18.25 in³/rev (299 cm³/rev) =	Size 300= 300
27.41 in³/rev (449.1 cm³/rev) =	Size 450= 450
36.60 in³/rev (599.7 cm³/rev) =	Size 600= 600
48.76 in³/rev (799 cm³/rev) =	Size 800= 800
60.96 in³/rev (999 cm³/rev) =	Size 1000= 1000

Motor Model MR

11.77 in³/rev (192.8 cm³/rev) =	Size 190 = 190
18.56 in³/rev (304.1 cm³/rev) =	Size 300 = 300
27.56 in³/rev (451.6 cm³/rev) =	Size 450 = 450
43.13 in³/rev (706.8 cm³/rev) =	Size 700 = 700
68.71 in³/rev (1126 cm³/rev) =	Size 1100 = 1100
110.39 in³/rev (1809 cm³/rev) =	Size 1800 = 1800
145.24 in³/rev (2380 cm³/rev) =	Size 2400 = 2400
169.65 in³/rev (2780 cm³/rev) =	Size 2800 = 2800
221.94 in³/rev (3637 cm³/rev) =	Size 3600 = 3600
274.79 in³/rev (4503 cm³/rev) =	Size 4500 = 4500
426.86 in³/rev (6995 cm³/rev) =	Size 7000 = 7000

Motor Model MRE

83.60 in³/rev (1370 cm³/rev) =	Size 1400 = 1400
127.60 in³/rev (2091 cm³/rev) =	Size 2100 = 2100
193.87 in³/rev (3117 cm³/rev) =	Size 3100 = 3100
329.59 in³/rev (5401 cm³/rev) =	Size 5400 = 5400
520.23 in³/rev (8525 cm³/rev) =	Size 8500 = 8500

Drive shaft

Metric splined shaft	= N [4]
Metric parallel keyed shaft to ISO 2491	= P [1]
Hollow shaft with internal gear	= F
Splined shaft BS 3550	= B [2; 3]
Splined shaft DIN 5480	= D [2; 3]
Tapered shaft 1 : 10	= C [2; 3]

Series - Motor

Actual Series (1 to 9), see name plate = X

Series- Speed sensor

X = Actual Series (1 to 9), see name plate

Speed detection (see page 41)

no code =	Without speed sensor
E =	Electrical pulse generator
[3] C =	Tongued shaft Ø 0.236 in (6 mm)
[3] T =	Tongued shaft Ø 0.236 in (6 mm) with coupling
[3] Q =	Parallel shaft Ø 0.315 in (8 mm)

Seals

no code =	Buna-N seals suitable for use with HM, HL, HLP petroleum oils
[1] V =	Viton seals suitable for use with HFD-R phosphate ester fluids
[3] F =	Shaft seal for 215 PSI (15 bar) housing pressure max.. Buna-N seals
U =	Without shaft seal (ex. with holding brake) Buna-N seals

Control

no code =	*Standard* Clockwise rotation; inlet is A Counter-clockwise rotation; inlet is B
S =	*Rotated control* Clockwise rotation; inlet is B Counter-clockwise rotation; inlet is A

Rolling bearing

no code =	Standard
[1] H =	Extremely long life for HFB and HFC operation (Please consult product support)
[1] W =	

Further details in clear text

[1] for MRP on request

[2] for MR/MRE on request

[3] not for MRP

[4] Adaptor sleeves from metric spline to ISO parallel keyed shaft available, see pages ...

Typical order:

MRP 450 NX
MR 7000 PXEXFH

Technical Data (For applications outside these parameters, please consult us!)

General – MRP; MR; MRE

		Fixed displacement radial piston motor
		MRP, MR, MRE
		Flange mounting (or with torque pins) [2]
		Connection flange
		Any (please see installation notes, page 48)
		See pages 42 and 43
		Clockwise, counter-clockwise - reversible
		HM, HL, HLP petroleum oils; HFB and HFC on request: Viton seals are required with phosphate ester fluids (HFD-R)
	t °F (°C)	- 22 ... 176 (– 30 ... 80)
	ν SUS (mm²/s)	90 ... 465 (18 ... 1000) Recommended operating range 140 ... 230 (30 ... 50)
...sible degree of contamination		ISO 4406, class 18/15. Therefore, we recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$. To ensure a long life we recommend ISO 4406, class 17/14. This can be achieved with a filter, with a minimum retention rate of $\beta_5 \geq 100$.

MRP

		200	250	300	450	600	800	1000
	in³/rev (cm³/rev)	12.14 (199)	15.19 (249)	18.25 (299)	27.41 (449.1)	36.60 (599.7)	48.76 (799)	60.96 (999)
	lb mass in² (kg cm²)	21.186 (62)	21.186 (62)	21.186 (62)	93.972 (275)	93.972 (275)	170.859 (500)	170.859 (500)
...specific torque	lb-ft/PSI (daNm/bar)	0.161 (0.318)	0.202 (0.397)	0.242 (0.476)	0.363 (0.715)	0.485 (0.974)	0.647 (1.272)	0.808 (1.589)
...torque	%	86	88	90	89	91	90	92
...inuous pressure	PSI (bar)	3045 (210)						
...ermittent pressure	PSI (bar)	3625 (250)						
...peak pressure	PSI (bar)	4570 (315)						
...ombined pressure in ports A & B	PSI (bar)	3625 (250)						
...ge pressure	PSI (bar)	36 (2.5)						
...inuous power	HP (kW)	25.5 (19)	32.2 (24)	37.5 (28)	48.3 (36)	59.0 (44)	71.1 (53)	83.1 (62)
...ermittent power	HP (kW)	37.5 (28)	48.3 (36)	56.3 (42)	72.4 (54)	88.5 (66)	107.3 (80)	124.7 (93)
	lbs (kg)	106 (48)			172 (78)		258 (117)	

...ion outside these parameters, please consult us!

...consultation with product support!

Technical Data (For operation outside these parameters, please consult us!)

MR

Size		190	300	450	700	1100	1800	2400	2800	3600	4500	7000
Displacement	in^3/rev. (cm^3/rev)	11.77 (192.8)	18.56 (304.1)	27.56 (451.6)	43.13 (706.8)	68.71 (1126)	110.39 (1809)	145.24 (2380)	169.65 (2780)	221.94 (3637)	274.79 (4503)	426.86 (6995
Moment of inertia of rotating parts	lb mass in^2 (kg/cm^2)	11.96 (35)	21.19 (62)	44.42 (130)	93.97 (275)	170.9 (500)	375.9 (1,100)	495.5 (1,450)	580.9 (1,700)	1,111 (3,250)	1,367 (4,000)	2.734 (8.000
Theoretical specific torque	lb-ft/PSI (daNm/bar)	0.156 (0.307)	0.246 (0.484)	0.365 (0.719)	0.569 (1.12)	0.910 (1.79)	1.464 (2.88)	1.927 (3.79)	2.253 (4.43)	2.939 (5.78)	3.646 (7.17)	5.665 (11.14
Minimum starting torque / Theoretical torque	%	90	89	89	90	91	90	90	90	90	91	91
Maximum continous pressure		3625 PSI (250 bar)										
Maximum intermittent pressure		4350 PSI (300 bar)										
Maximum peak pressure		6100 PSI (420 bar)										
Maximum combined pressure A + B		5800 PSI (400 bar)										
Maximum case pressure		36 PSI (2.5 bar)										
Speed range	rpm	1 ... 550	1 ... 500	1 ... 450	1 ... 400	0.5 ... 300	0.5 ... 250	0.5 ... 220	0.5 ... 200	0.5 ... 195	0.5 ... 170	0.5 130
Maximum continous power	HP (kW)	32.2 (24)	46.9 (35)	61.7 (46)	87.2 (65)	103.3 (77)	138.1 (103)	160.9 (120)	170.3 (127)	214.6 (160)	241.4 (180)	281 6 (210
Maximum intermittent power	HP (kW)	48.3 (36)	71.1 (53)	100.6 (75)	130.1 (97)	159.6 (119)	210.5 (157)	245.4 (183)	260.2 (194)	327.2 (244)	362.1 (270)	429.1 (320)
Weight (approx.)	lbs (kg)	99 (44)	117 (52)	176 (78)	216 (98)	309 (140)	470 (213)	723 (328)	723 (328)	1,212 (539)	1,212 (539)	1.653 (735)

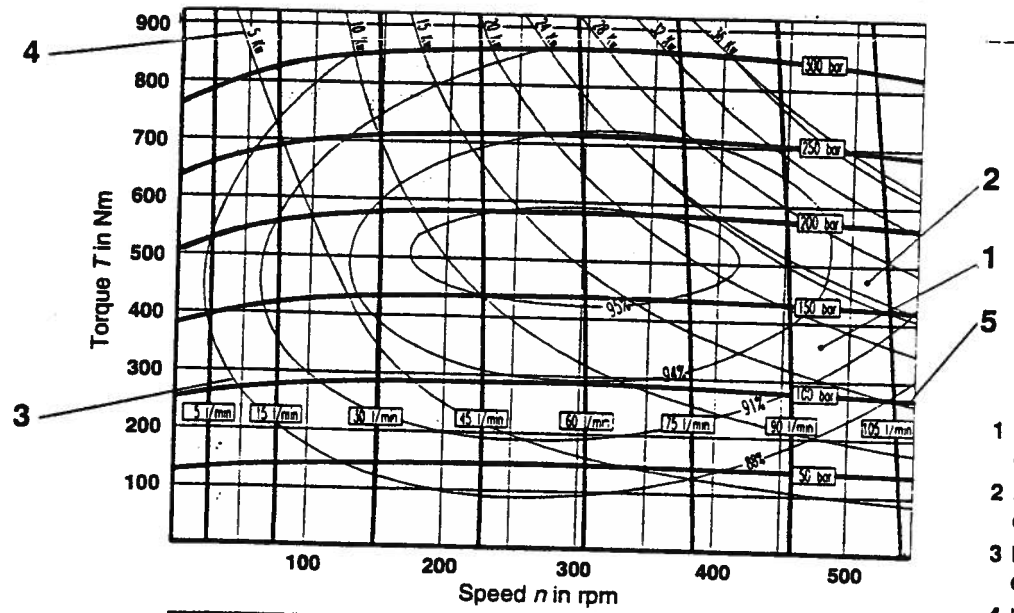
MRE [1]

Size		1400	2100	3100	5400	8500
Displacement	in^3 (cm^3)	83.60 (1370)	127.60 (2091)	193.87 (3117)	329.59 (5401)	520.23 (8525)
Moment of inertia	lb mass in^2 ($kg\ cm^2$)	170.9 (500)	375.9 (1,100)	580.9 (1,700)	1,366.9 (4,000)	2,733.7 (8,000)
Theoretical specific torque	lb-ft/PSI (daNm/bar)	1.108 (2.18)	1.693 (3.33)	2.521 (4.96)	4.366 (8.59)	6.894 (13.56)
Minimum starting torque / Theoretical torque	%	92	91	91	92	92
Maximum continous pressure		3045 PSI (210 bar)				
Maximum intermittent pressure		3625 PSI (250 bar)				
Maximum peak pressure		5075 PSI (350 bar)				
Maximum combined pressure A + B		5800 PSI (400 bar)				
Maximum case pressure		36 PSI (2.5 bar)				
Speed range	rpm	0.5 ... 280	0.5 ... 245	0.5 ... 205	0.5 ... 160	0.5 ... 120
Maximum continous power	HP (kW)	100.6 (75)	134.1 (100)	167.6 (125)	228.0 (170)	268.2 (200)
Maximum intermittent power	HP (kW)	154.2 (115)	201.2 (150)	254.8 (190)	342.0 (255)	402.3 (300)
Weight (approx.)	lbs (kg)	315 (143)	478 (217)	736 (334)	1,213 (550)	1,653 (750)

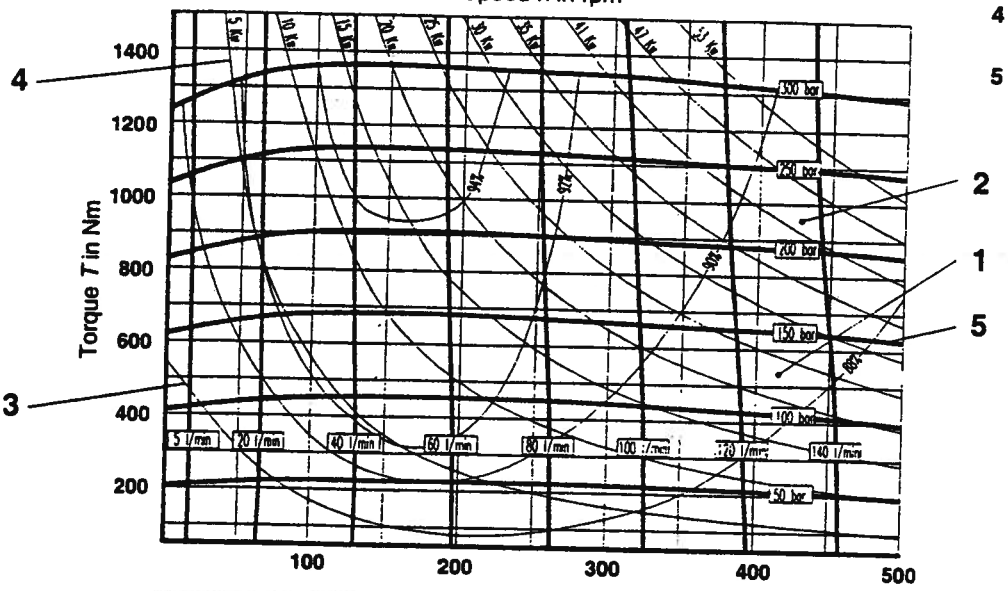
[1] **Warning!**
Size 5400 and 8500 MRE motors may only be used in applications, where no cavitation in likely to occur!

Operating Curves (average values) measured at v = 167 SUS (36 mm²/s); t = 113 °F (45 °C); p_{outlet} ≈ 0 PSI (0 bar)

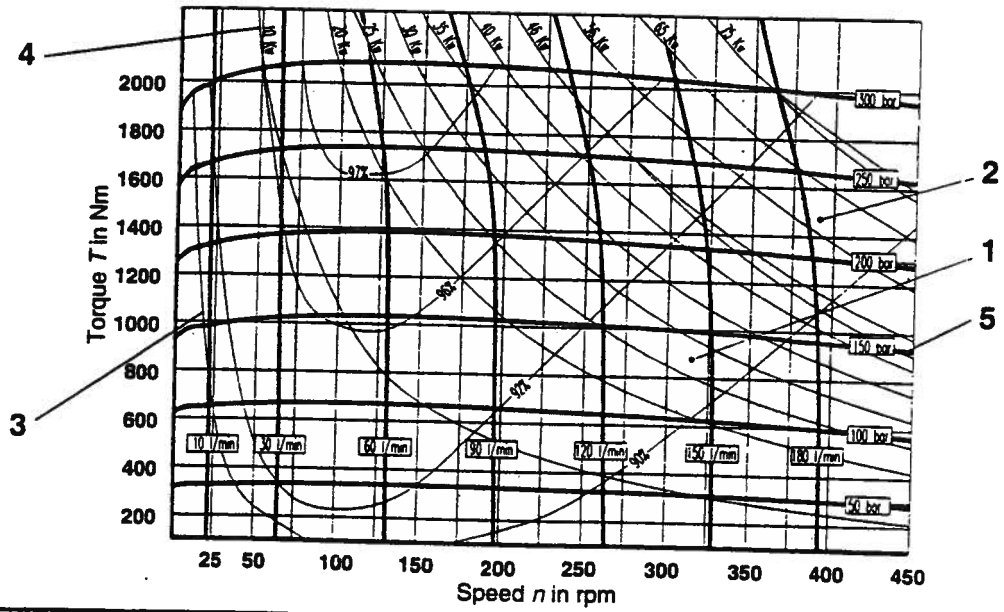
MR 190



MR 300



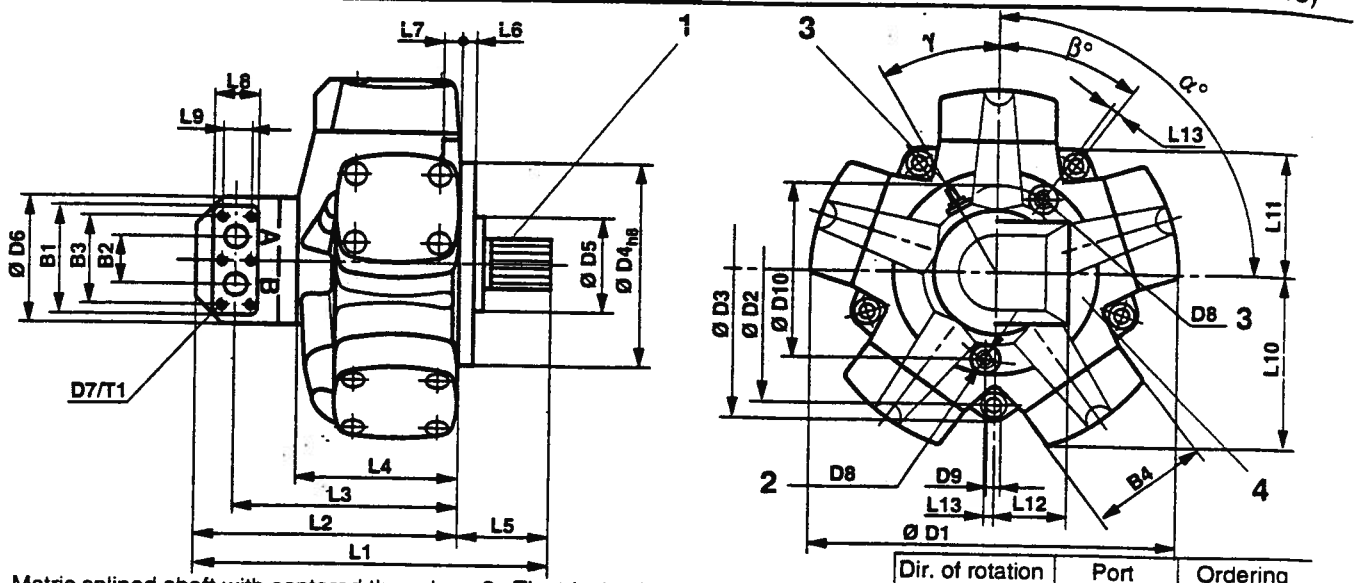
MR 450



1 For continuous operation
2 For intermittent operation
3 Mechanical efficiency η_{mech}
4 "Outlet" power
5 Inlet pressure

Unit dimensions: MR and MRE

(Dimensions in inches and millimeters)



1 Metric splined shaft with centered thread (for dimensions see page 19) Ordering code "N" (for further shaft ends see page 19)

2 Case drain port

3 Electrical pulse generator (speed sensor) Ordering Code "E" angle γ on request

4 Can be rotated in 72° increments (5 mounting holes)

Dir. of rotation (Viewed on shaft end)	Port inlet	Ordering code
Clockwise	A	Standard
Counter clockwise	B	"no code"
Clockwise	B	"S"
Counter clockwise	A	

* For adaptors from BSP to SAE straight thread, see RA 45 530

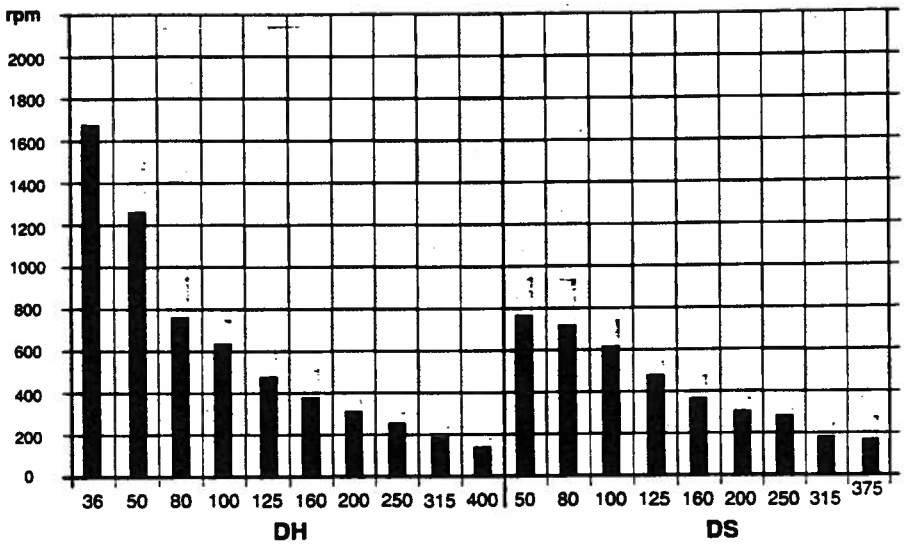
BSP threads to ISO 228/1

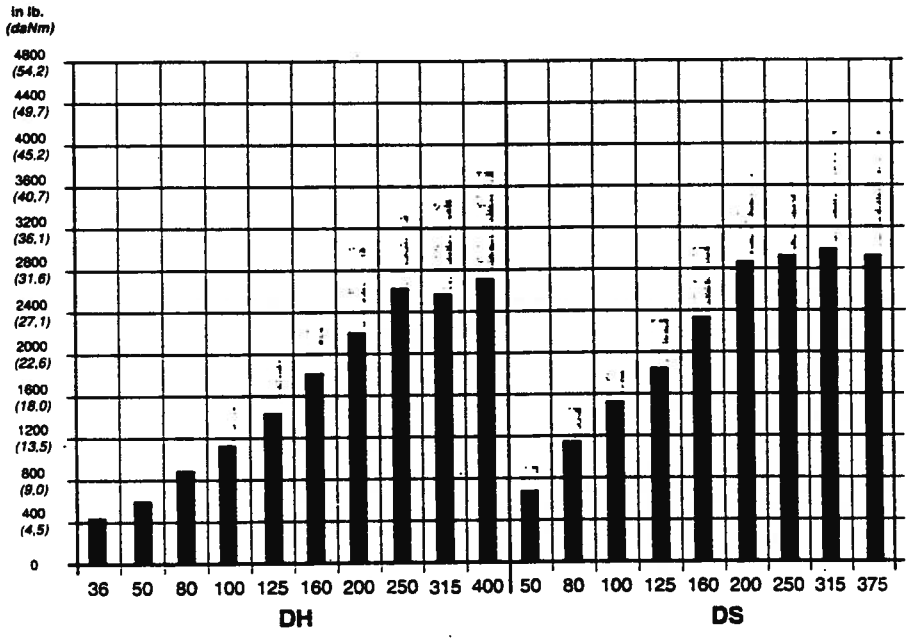
Model	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	B1	B2	B3	B4
MR 190 N	11.17(299)	9.13 (232)	7.56 (192)	5.24 (133)	2.64 (67)	0.55 (14)	0.59 (15)	2.13 (54)	1.34 (34)	5.59 (142)	4.05 (103)	2.83 (72)	0.26 (6.5)	4.72 (120)	1.97 (50)	3.94 (100)	3.94 (100)
MR 300 N	12.60(320)	9.41 (239)	7.83 (199)	5.51 (140)	3.19 (81)	0.59 (15)	0.63 (16)	2.13 (54)	1.34 (34)	6.02 (153)	4.68 (119)	2.83 (72)	0.29 (7.5)	4.72 (120)	1.97 (50)	3.94 (100)	3.94 (100)
MR 450 N	14.80(376)	10.98(279)	8.66 (220)	6.57 (167)	3.82 (97)	0.59 (15)	0.71 (18)	2.44 (62)	1.57 (40)	6.85 (174)	5.12 (130)	3.31 (84)	0.37 (9.5)	5.59 (142)	2.36 (60)	4.72 (120)	4.69 (119)
MR 700 N	15.83(402)	11.77(299)	10.04(255)	7.56 (192)	3.98 (101)	0.59 (15)	0.79 (20)	2.77(70.4)	1.57 (40)	7.56 (192)	5.51 (140)	3.31 (84)	0.31 (8)	5.59 (142)	2.36 (60)	4.72 (120)	5.24 (133)
MR 1100 N MRE 1400 N	17.91 (455)	13.31 (338)	11.42 (290)	7.99 (203)	4.61 (117)	0.79 (20)	0.87 (22)	3.23 (82)	1.97 (50)	8.78 (223)	6.50 (165)	4.13 (105)	0.35 (9)	6.38 (162)	2.87 (73)	5.35 (136)	5.83 (148)
MR 1800 N MRE 2100 N	19.80 (503)	14.61 (371)	12.72 (323)	9.29 (236)	5.20 (132)	0.83 (21)	0.94 (24)	3.23 (82)	1.97 (50)	10.31 (262)	7.76 (197)	4.13 (105)	0.43 (11)	6.38 (162)	2.87 (73)	5.35 (136)	6.61 (168)
MR 2400 N MR 2800 N MRE 3100 N	24.13 (613)	18.11 (460)	15.43 (392)	11.22 (285)	6.02 (153)	0.94 (24)	1.02 (26)	3.86 (98)	2.44 (62)	11.81 (300)	8.70 (221)	4.84 (123)	0.59 (15)	8.19 (208)	3.39 (86)	7.09 (180)	7.40 (188)
MR 3600 N MR 4500 N MRE 5400 N	27.36 (695)	19.05 (485)	16.48 (418.5)	12.11 (307.5)	8.27 (210)	1.26 (32)	1.10 (28)	3.86 (98)	2.68 (68)	14.17 (360)	9.72 (247)	5.51 (140)	0.75 (19)	9.05 (230)	4.41 (112)	7.87 (200)	9.45 (240)
MR 7000 N MRE 8500 N	29.43 (747.5)	20.37 (517.5)	17.76 (451)	13.39 (340)	9.05 (230)	1.26 (32)	1.18 (30)	3.86 (98)	2.68 (68)	15.90 (404)	10.71 (272)	5.51 (140)	0.83 (21)	9.05 (230)	4.41 (112)	7.87 (200)	10.55 (268)

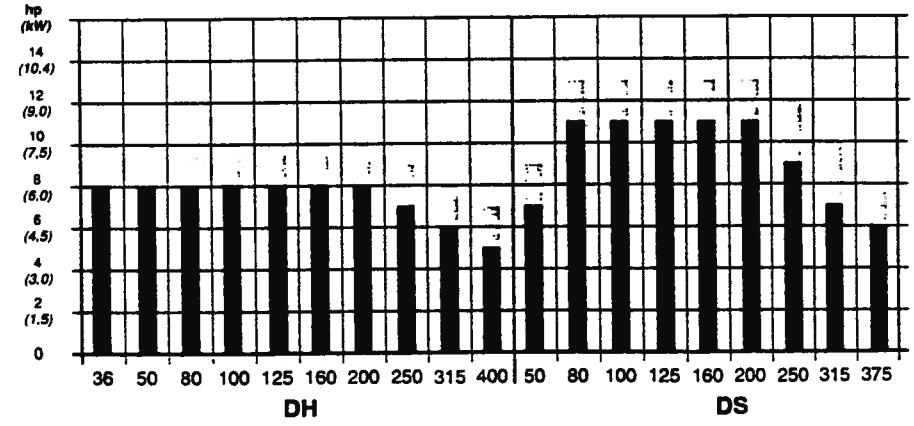
Model	Ø D1	Ø D2	Ø D3	Ø $D4_{h8}$	Ø D5	Ø D6	D7	T1	D8	D9	Ø D10	α	β
MR 190 N	11.73 (298)	8.86 (225)	9.80 (249)	6^{2992} (160^{000})	–	5.08 (129)	M8x1.25 (M8)	0.59 (15)	G 1/4" (BSP)*	0.43 (11)	6.30 (160)	90°	36°
MR 300 N	12.91 (328)	9.13 (232)	10.08 (256)	6^{8897} (175^{000})	3.54 (90)	5.08 (129)	M8x1.25 (M8)	0.59 (15)	G 1/4" (BSP)*	0.43 (11)	6.38 (162)	90°	36°
MR 450 N	14.33 (364)	10.47 (266)	11.65 (296)	7^{4803} (190^{000})	3.78 (96)	6.14 (156)	M10x1.5 (M10)	0.71 (18)	G 1/4" (BSP)*	0.51 (13)	7.64 (194)	90°	36°
MR 700 N	15.94 (405)	11.42 (290)	12.60 (320)	8^{6614} (220^{000})	4.06 (102)	6.14 (156)	M10x1.5 (M10)	0.71 (18)	G 3/8" (BSP)*	0.51 (13)	8.15 (207)	90°	36°
MR 1100 N MRE 1400 N	18.19 (462)	12.99 (330)	14.25 (367)	9^{8425} (250^{000})	4.72 (120)	6.77 (172)	M12x1.75 (M12)	0.87 (22)	G 1/2" (BSP)*	0.59 (15)	8.98 (228)	104°	36°
MR 1800 N MRE 2100 N	21.57 (548)	14.96 (380)	16.65 (423)	11^{4173} (290^{000})	5.83 (148)	7.87 (200)	M12x1.75 (M12)	0.87 (22)	G 1/2" (BSP)*	0.67 (17)	10.47 (266)	90°	36°
MR 2400 N MR 2800 N MRE 3100 N	25.28 (642)	17.32 (440)	19.45 (494)	13^{1889} (335^{000})	5.51 (140)	8.46 (215)	M14x2 (M14)	1.10 (28)	G 1/2" (BSP)*	0.75 (19)	12.36 (314)	90°	36°
MR 3600 N MR 4500 N MRE 5400 N	30.16 (766)	21.26 (540)	23.50 (597)	15^{7480} (400^{000})	–	9.45 (240)	M16x2 (M16)	1.18 (30)	G 1/2" (BSP)*	0.90 (23)	14.96 (380)	108°	36°
MR 7000 N MRE 8500 N	33.70 (856)	23.62 (600)	25.93 (658.6)	17^{7165} (450^{000})	7.48 (190)	9.45 (240)	M16x2 (M16)	1.18 (30)	G 1/2" (BSP)*	0.98 (25)	16.93 (430)	108°	36°

Speed, torque and output

HYDRAULIC COMPONENT
REFERENCE DWG #424-8001-01/8007-01
ITEM # HM - 2
MANUFACTURER: DANFOSS, SILSBY WASHINGTON AVE
DESCRIPTION: HYDRAULIC MOTOR
PART NUMBER: 151 - 2003 - DH 100

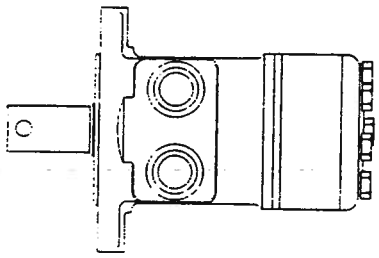


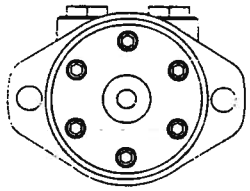




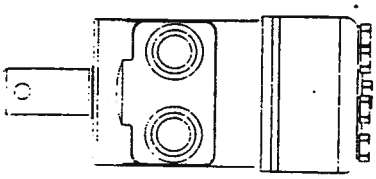
Code numbers and weight for DH motors

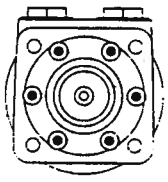
Port thread	Flange	Shaft	DH 36	DH 50	DH 80	DH 100	DH 125	DH 160	DH 200	DH 250	DH 315	DH 400
7/8 - 14 UNF	A2	ϕ1"	151-2000	151-2001	151-2002	151-2003	151-2004	151-2005	151-2006	151-2007	151-2008	151-2009
		1" - 6B spl.	151-2010	151-2011	151-2012	151-2013	151-2014	151-2015	151-2016	151-2017	151-2018	151-2019
		ϕ1" Cross-hole	151-2020	151-2021	151-2022	151-2023	151-2024	151-2025	151-2026	151-2027	151-2028	151-2029
		7/8" - 13T spl.	151-2030	151-2031	151-2032	151-2033	151-2034	151-2035	151-2036	151-2037	151-2038	151-2039
1/2 - 14 NPTF	A2	ϕ1"	151-2080	151-2081	151-2082	151-2083	151-2084	151-2085	151-2086	151-2087	151-2088	151-2089
		1" - 6B spl.	151-2090	151-2091	151-2092	151-2093	151-2094	151-2095	151-2096	151-2097	151-2098	151-2099
		ϕ1" Cross-hole	151-2100	151-2101	151-2102	151-2103	151-2104	151-2105	151-2106	151-2107	151-2108	151-2109
		7/8" - 13T spl.	151-2110	151-2111	151-2112	151-2113	151-2114	151-2115	151-2116	151-2117	151-2118	151-2119
Manifold	A2	ϕ1"	151-2160	151-2161	151-2162	151-2163	151-2164	151-2165	151-2166	151-2167	151-2168	151-2169
		1" - 6B spl.	151-2170	151-2171	151-2172	151-2173	151-2174	151-2175	151-2176	151-2177	151-2178	151-2179
		ϕ1" Cross-hole	151-2180	151-2181	151-2182	151-2183	151-2184	151-2185	151-2186	151-2187	151-2188	151-2189
		7/8" - 13T spl.	151-2190	151-2191	151-2192	151-2193	151-2194	151-2195	151-2196	151-2197	151-2198	151-2199
Weight	A2	lb	11.2	11.2	11.5	11.9	12.1	12.6	13.0	13.5	14.1	15.2
		(kg)	*(5,1)*	*(5,1)*	*(5,2)*	*(5,4)*	*(5,5)*	*(5,7)*	*(5,9)*	*(6,1)*	*(6,4)*	*(6,9)*





Port thread	Flange	Shaft	DH 36	DH 50	DH 80	DH 100	DH 125	DH 160	DH 200	DH 250	DH 315	DH 400
7/8 - 14 UNF	C	ϕ1"	151-2040	151-2041	151-2042	151-2043	151-2044	151-2045	151-2046	151-2047	151-2048	151-2049
		1" - 6B spl.	151-2050	151-2051	151-2052	151-2053	151-2054	151-2055	151-2056	151-2057	151-2058	151-2059
		ϕ1" Cross-hole	151-2060	151-2061	151-2062	151-2063	151-2064	151-2065	151-2066	151-2067	151-2068	151-2069
		7/8" - 13T spl.	151-2070	151-2071	151-2072	151-2073	151-2074	151-2075	151-2076	151-2077	151-2078	151-2079
1/2 - 14 NPTF	C	o1"	151-2120	151-2121	151-2122	151-2123	151-2124	151-2125	151-2126	151-2127	151-2128	151-2129
		1" - 6B spl.	151-2130	151-2131	151-2132	151-2133	151-2134	151-2135	151-2136	151-2137	151-2138	151-2139
		ϕ1" Cross-hole	151-2140	151-2141	151-2142	151-2143	151-2144	151-2145	151-2146	151-2147	151-2148	151-2149
		7/8" - 13T spl.	151-2150	151-2151	151-2152	151-2153	151-2154	151-2155	151-2156	151-2157	151-2158	151-2159
Manifold	C	ϕ1"	151-2200	151-2201	151-2202	151-2203	151-2204	151-2205	151-2206	151-2207	151-2208	151-2209
		1" - 6B spl.	151-2210	151-2211	151-2212	151-2213	151-2214	151-2215	151-2216	151-2217	151-2218	151-2219
		ϕ1" Cross-hole	151-2220	151-2221	151-2222	151-2223	151-2244	151-2225	151-2226	151-2227	151-2228	151-2229
		7/8" - 13T spl.	151-2230	151-2231	151-2232	151-2233	151-2234	151-2235	151-2236	151-2237	151-2238	151-2239
Weight	C	lb	10.6	10.6	10.8	11.2	11.5	11.9	12.4	12.8	13.5	14.6
		(kg)	*(4,8)*	*(4,8)*	*(4,9)*	*(5,1)*	*(5,2)*	*(5,4)*	*(5,6)*	*(5,8)*	*(6,1)*	*(6,6)*





Technical Data

Motor Type			DH 36	DH 50	DH 80	DH 100	DH 125	DH 160	DH 200	DH 250	DH 315	DH 400
Displacement	in^3/rev *(cm^3/rev)*		2.2 *(36)*	3.0 *(50)*	4.8 *(80)*	5.9 *(100)*	7.6 *(125)*	9.5 *(160)*	11.9 *(200)*	14.8 *(250)*	18.7 *(315)*	23.8 *(400)*
Max. speed	rpm	cont.	1680	1249	778	622	484	389	311	250	198	156
	rpm	int.	1942	1561	973	778	606	486	389	313	247	195
Max. torque[1]	in/lb *(da/Nm)*	cont.	420 *(4,8)*	565 *(6,4)*	907 *(10,2)*	1134 *(12,8)*	1457 *(16,5)*	1814 *(20,5)*	2267 *(25,6)*	2633 *(29,7)*	2615 *(29,5)*	2722 *(30,7)*
	in/lb *(daNm)*	int.	560 *(6,3)*	754 *(8,5)*	1210 *(13,7)*	1513 *(17,1)*	1943 *(21,9)*	2419 *(27,3)*	3023 *(34,2)*	3385 *(38,2)*	3566 *(40,3)*	3780 *(42,7)*
Max. output	hp *(kW)*	cont.	8 *(6,0)*	8 *(6,0)*	8 *(6,0)*	8 *(6,0)*	8 *(6,0)*	8 *(6,0)*	8 *(6,0)*	7 *(5,2)*	6 *(4,5)*	5 *(3,7)*
	hp *(kW)*	int.	10 *(7,5)*	10 *(7,5)*	10 *(7,5)*	10 *(7,5)*	10 *(7,5)*	10 *(7,5)*	10 *(7,5)*	9 *(6,7)*	8 *(6,0)*	7 *(5,2)*
Max. pressure drop	psi *(bar)*	cont.	1500 *(103)*	1500 *(103)*	1500 *(103)*	1500 *(103)*	1500 *(103)*	1500 *(103)*	1500 *(103)*	1400 *(97)*	1100 *(76)*	900 *(62)*
	psi *(bar)*	int.	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*	1800 *(124)*	1500 *(103)*	1250 *(86)*
Max. oil flow	gpm *(l/min)*	cont.	16 *(60)*	16 *(60)*	16 *(60)*	16 *(60)*	16 *(60)*	16 *(60)*	16 *(60)*	16 *(60)*	16 *(60)*	16 *(60)*
	gpm *(l/min)*	int.	18.5 *(70)*	20 *(76)*	20 *(76)*	20 *(76)*	20 *(76)*	20 *(76)*	20 *(76)*	20 *(76)*	20 *(76)*	20 *(76)*
Max. inlet pressure	psi *(bar)*	cont.	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*
	psi *(bar)*	int.	2500 *(172)*	2500 *(172)*	2500 *(172)*	2500 *(172)*	2500 *(172)*	2500 *(172)*	2500 *(172)*	2500 *(172)*	2500 *(172)*	2500 *(172)*
Max. return pressure with drain line	psi *(bar)*	cont.	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*	2000 *(138)*
	psi *(bar)*	int.	2500 *(172)*	2500 *(172)*	2500 *(172)*	2500 *(172)*	2500 *(172)*	2500 *(172)*	2500 *(172)*	2500 *(172)*	2500 *(172)*	2500 *(172)*
Max. starting pressure with unloaded shaft	psi *(bar)*		150 *(10)*	150 *(10)*	150 *(10)*	150 *(10)*	150 *(10)*	150 *(10)*	100 *(7)*	100 *(7)*	100 *(7)*	100 *(7)*
Min. starting torque at max. pressure drop	in/lbs. *(daNm)*	cont	350 *(3,9)*	525 *(5,9)*	940 *(10,6)*	1130 *(12,8)*	1400 *(15,8)*	1890 *(21,3)*	2250 *(25,4)*	2780 *(31,4)*	2630 *(29,7)*	2680 *(30,2)*
	in/lbs. *(daNm)*	int.		700 *(7,9)*	1190 *(13,4)*	1500 *(16,9)*	1860 *(21,0)*	2480 *(28,0)*	3000 *(33,9)*	3450 *(38,7)*	3500 *(39,5)*	3550 *(40,1)*
Min. speed [2]	rpm			15	10	10	10	10	10	5	5	5

Simultaneous intermittent torque and intermittent speed is **not** recommended.

Maximum return pressure without drain line or maximum pressure in drain line for all models—continuous: 0-100 rpm: 1800 psi (124 bar); 100-300 rpm: 1100 psi (76 bar); 600 rpm: 725 psi (50 bar); > 600 rpm: 365 psi (25 bar). Intermittent: 0-max. rpm: 1800 psi (124 bar). The pressure on the shaft seal is equal to the average of the inlet sure and the return pressure.

[1] 6B splined shaft or 7/8 in 13 T splined shaft is recommended for operating torques of 2500 in/lbs. *(28 daNm)* or more.

[2] Operation at lower speeds may be slightly less smooth.

HYDRAULIC COMPONENT

REFERENCE DWG #424-8001-01 / 8007-01

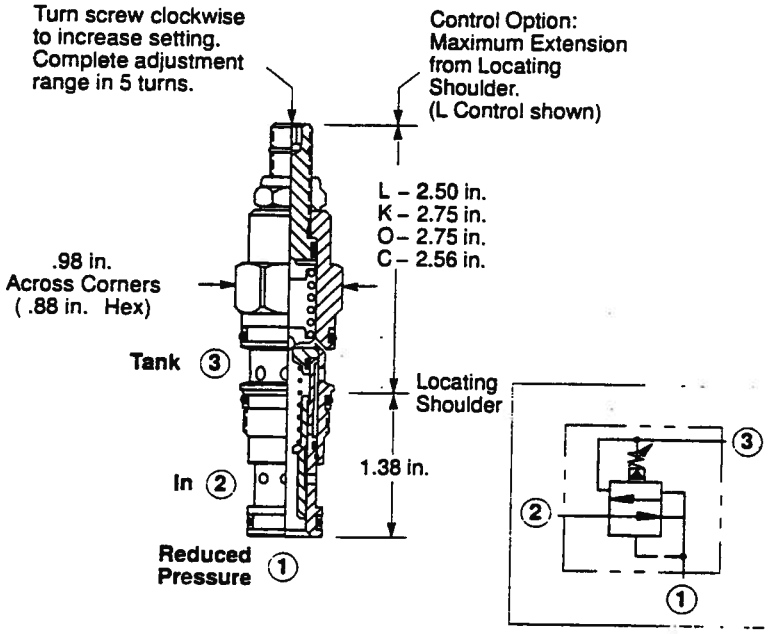
ITEM # PRRV-1

MANUFACTURER: SUN, 1500 W. UNIVERSITY PKWY. SARASOTA, FL 34243 813-355-2783

DESCRIPTION: PRESSURE REDUCING/RELIEVING V

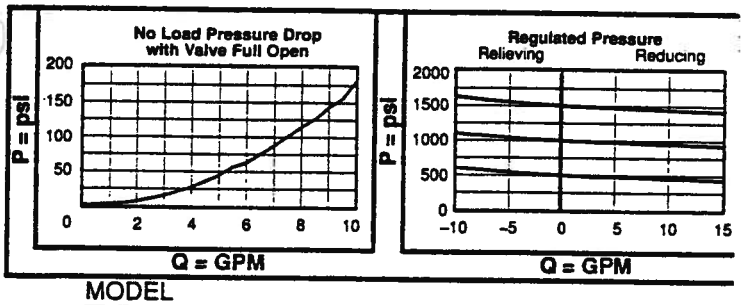
PART NUMBER: PPDB-LBN-ECI

0 to 10 GPM Nominal
Series 1 Cartridge T-11A Cavity
Installation Torque 30 to 35 lb. ft.



3

⊗ Maximum pressure differential, inlet to outlet, see adjustment ranges.
Pressure at Port 3 is directly additive to valve setting and should not exceed 3000 psi.
Control pilot flow = 7 to 10 in³/min.



MODEL
PPDB-LAN

OPTIONS

PP * B – * * * – * * * / *

Basic cartridge from above

CONTROLS
See page x for more details on Optional Controls

- **L** Standard Screw Adjustment
- **K** Handknob with Lock Knob
- **O** Handknob with Panel Mount

Nonstandard Controls

- **C** Tamper Resistant Factory Set

⊗ ADJUSTMENT RANGES

- **A** 100 to 3000 psi, 200 psi Standard Setting, Maximum Differential = 3000 psi
- **B** 50 to 1500 psi, 200 psi Standard Setting, Maximum Differential = 3000 psi
- **D** 25 to 800 psi, 200 psi Standard Setting, Maximum Differential = 2000 psi
- **E** 25 to 400 psi, 200 psi Standard Setting, Maximum Differential = 2000 psi
- **H** 30 to 3000 psi, 200 psi Standard Setting, Maximum Differential = 3000 psi
- **W** 150 to 4500 psi, 200 psi Standard Setting, Maximum Inlet Pressure = 5000 psi
- Customer Specified Setting Stamped on Hex

SEALS

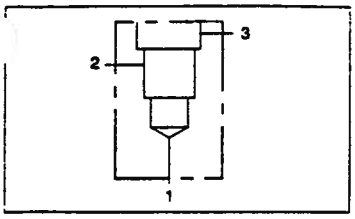
- **N** Buna–N
- **V** Viton

BODY

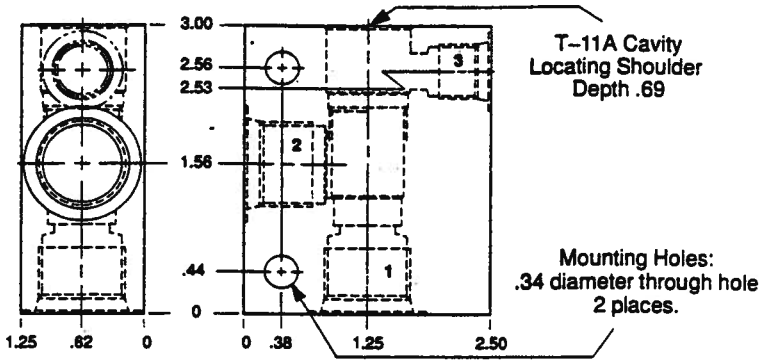
Omit for Cartridge Only
or
See Body Locator Page 3.04

LINE MOUNTED BODIES

- Aluminum rated to 3000 psi.
- Ductile Iron rated to 5000 psi.

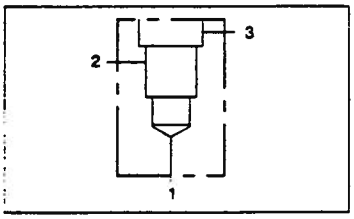


90 degree body.

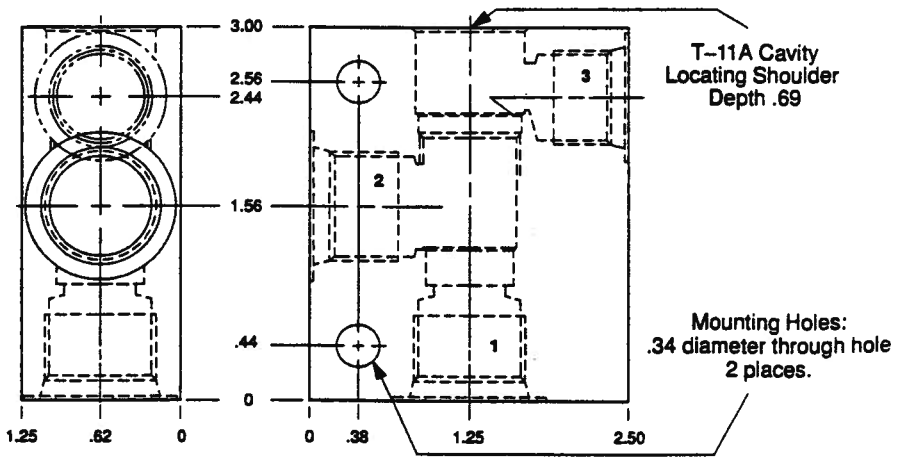


TYPICAL CARTRIDGES USED WITH THIS BODY

Ports 1 & 2	Port 3	ALUMINUM Part Number	ALUMINUM List Price	DUCTILE IRON Part Number	DUCTILE IRON List Price
.25 NPTF	.25 NPTF	ECA		ECA/S	
.375 NPTF	.25 NPTF	ECB		ECB/S	
.50 NPTF	.25 NPTF	ECC		ECC/S	
SAE-4	SAE-4	ECH		ECH/S	
SAE-6	SAE-6	ECI		ECI/S	
SAE-8	SAE-6	ECJ		ECJ/S	
SAE-10	SAE-6	ECK		ECK/S	
.25 BSPP	.25 BSPP	ECT		ECT/S	
.375 BSPP	.25 BSPP	ECU		ECU/S	
.50 BSPP	.25 BSPP	ECV		ECV/S	



90 degree body with high capacity port 3.



TYPICAL CARTRIDGES USED WITH THIS BODY

Ports 1 & 2	Port 3	ALUMINUM Part Number	ALUMINUM List Price	DUCTILE IRON Part Number	DUCTILE IRON List Price
.375 NPTF	.375 NPTF	EAB		EAB/S	
.50 NPTF	.375 NPTF	EAC		EAC/S	
SAE-8	SAE-8	EAJ		EAJ/S	
SAE-10	SAE-8	EAK		EAK/S	
.375 BSPP	.375 BSPP	EAU		EAU/S	
.50 BSPP	.375 BSPP	EAV		EAV/S	

REFERENCE DWG #424-8001-01 / 8007-01

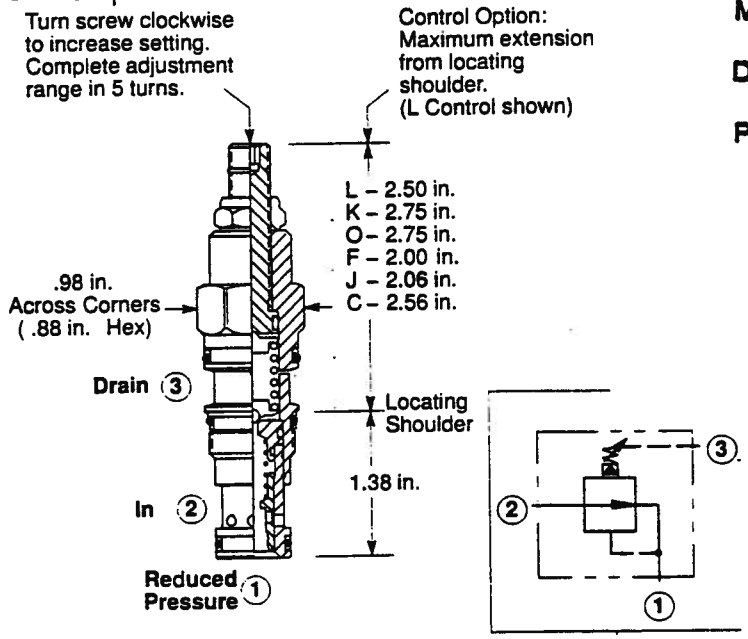
ITEM # PRV-1

MANUFACTURER: SUN, 1500 W. UNIVERSITY PKWY SARASOTA, FL 34243 813-355-2983

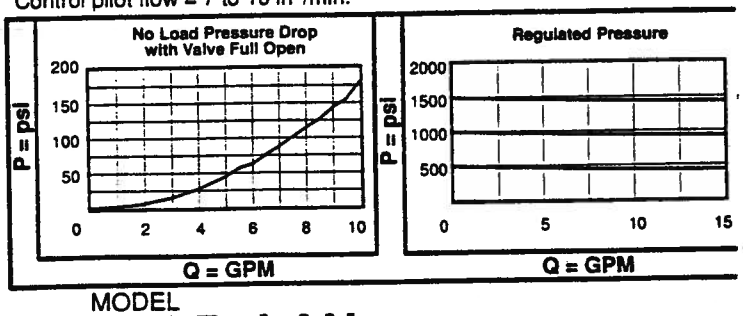
DESCRIPTION: PRESSURE REDUCING VALVE

PART NUMBER: PBDB-LAN-FCJ

0 to 10 GPM Nominal
Series 1 Cartridge T-11A Cavity
Installation Torque 30 to 35 lb. ft.



⊗Maximum pressure differential, inlet to outlet, see adjustment ranges.
Pressure at Port 3 is directly additive to valve setting and should not exceed 3000 psi.
Control pilot flow = 7 to 10 in³/min.



MODEL
PBDB-LAN

OPTIONS

PB* B – * – ***/***** Basic cartridge from above

CONTROLS
See page x for more details on Optional Controls

- **L** Standard Screw Adjustment
- **K** Handknob with Lock Knob
- **O** Handknob with Panel Mount
- **F** Hex Head Screw with Locknut
- **J** Socket Head Set Screw with Cap

Nonstandard Controls

- **C** Tamper Resistant Factory Set

⊗ADJUSTMENT RANGES

- **A** 100 to 3000 psi, 200 psi Standard Setting — Maximum Differential = 3000 psi
- **B** 50 to 1500 psi, 200 psi Standard Setting — Maximum Differential = 3000 psi
- **N** 60 to 800 psi, 200 psi Standard Setting — Maximum Differential = 2000 psi
- **Q** 60 to 400 psi, 200 psi Standard Setting — Maximum Differential = 2000 psi
- **W** 150 to 4500 psi, 200 psi Standard Setting — Maximum Inlet Pressure = 5000 psi

Customer Specified Setting Stamped on Hex

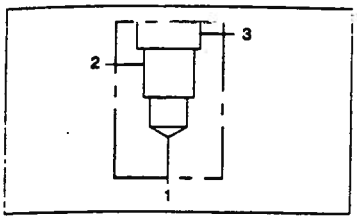
SEALS
- **N** Buna-N
- **V** Viton

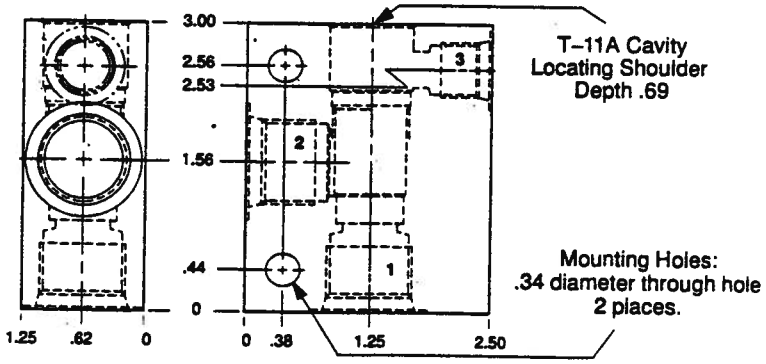
BODY
Omit for Cartridge Only
or
See Body Locator Page 3.04

LINE MOUNTED BODIES

- Aluminum rated to 3000 psi.
- Ductile Iron rated to 5000 psi.

90 degree body.





TYPICAL CARTRIDGES USED WITH THIS BODY

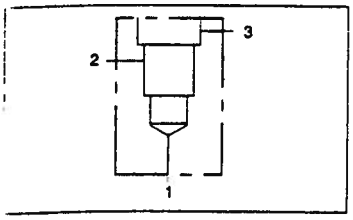
RBAD - ***	Page 1.17
RVCA - ***	Page 1.18
RSDC - ***	Page 2.06
SQDB - ***	Page 2.08
SCCA - ***	Page 2.12
PBDB - ***	Page 3.06
CBCA - ***	Page 4.10
CBCG - ***	Page 4.12
CBCH - ***	Page 4.14
CKCB - ***	Page 4.16
LODC - ***	Page 9.08
LKDC - ***	Page 9.10
LPDC - ***	Page 9.12
LRDC - ***	Page 9.14
CSAB - ***	Page 10.08
CDAB - ***	Page 10.10
CODA - ***	Page 10.12

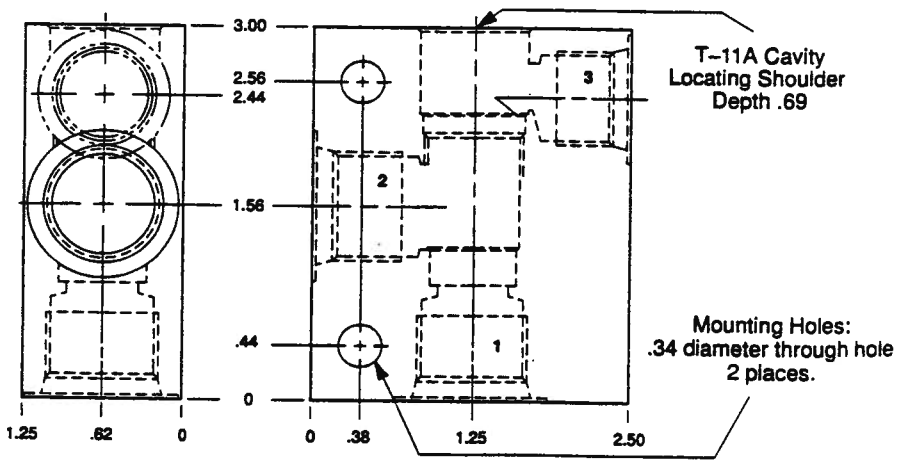
Instructions for ordering complete cartridge and body assemblies. Page v

Pressure ratings, material specifications. Page 11.02

Ports 1 & 2	Port 3	ALUMINUM Part Number	ALUMINUM List Price	DUCTILE IRON Part Number	DUCTILE IRON List Price
.25 NPTF	.25 NPTF	ECA		ECA/S	
.375 NPTF	.25 NPTF	ECB		ECB/S	
.50 NPTF	.25 NPTF	ECC		ECC/S	
SAE-4	SAE-4	ECH		ECH/S	
SAE-6	SAE-6	ECI		ECI/S	
SAE-8	SAE-6	ECJ		ECJ/S	
SAE-10	SAE-6	ECK		ECK/S	
.25 BSPP	.25 BSPP	ECT		ECT/S	
.375 BSPP	.25 BSPP	ECU		ECU/S	
.50 BSPP	.25 BSPP	ECV		ECV/S	

90 degree body with high capacity port 3.





TYPICAL CARTRIDGES USED WITH THIS BODY

PPDB - ***	Page 3.10
FRCA - ***	Page 6.02
DPBA - ***	Page 8.06
DPBB - ***	Page 8.07
DPBC - ***	Page 8.08
DPBD - ***	Page 8.09

Instructions for ordering complete cartridge and body assemblies. Page v

Pressure ratings, material specifications. Page 11.02

Ports 1 & 2	Port 3	ALUMINUM Part Number	ALUMINUM List Price	DUCTILE IRON Part Number	DUCTILE IRON List Price
.375 NPTF	.375 NPTF	EAB		EAB/S	
.50 NPTF	.375 NPTF	EAC		EAC/S	
SAE-8	SAE-8	EAJ		EAJ/S	
SAE-10	SAE-8	EAK		EAK/S	
.375 BSPP	.375 BSPP	EAU		EAU/S	
.50 BSPP	.375 BSPP	EAV		EAV/S	

HYDRAULIC COMPONENT

REFERENCE DWG #424-2001-01 / 2007-01

ITEM # SVV-1

MANUFACTURER: MOOG, EAST AURORA, NY 14052 716-652-2000

DESCRIPTION: SERVOVALVE

PART NUMBER: 631-102C w/A72022-

ERFORMANCE PARAMETERS

MODEL 631-102C

STATIC PARAMETERS

Operating Pressure	3000	PSI
Proof Pressure	3000	PSI
Single Coil Signal	100.00	MA(Coils in Parallel)
	50.00	MA(Coils in Series)
Permanent Wiring Configuration	SINGLECOIL	
Rated Flow	18.29 @ 1000	CIS(4.75 GPM) PSI Valve Drop
Polarity	POSITIVE	Signal- LEFT
Resistance	28.0	Ohms NOMINAL
Threshold	< 1.00	% of Rated Signal
Hysteresis	< 5.0	% of Rated Signal
Null Bias	<	% of Rated Signal Externally Adjustable
Pressure Centershift	<	% for 1000 PSI Change
Spool/Bushing Lap	OVER	
Leakage	< 2.80	CIS @ 3000 PSI
Seal Material	BUNA N 90D	

DYNAMIC PERFORMANCE

Frequency Response Scan

3000 PSI ZIR Pk to Pk < Db Peaking

Degree Lag > Hz

ELECTRICAL COMPONENT

REFERENCE DWG # 425-9001-01/9009

ITEM # 2, 3, 4

MANUFACTURER: IDEC, 1213 ELKO DR SUNNYVALE, CA 94089-408-747-0550

DESCRIPTION: FUSE BLOCK

PART NUMBER: BNF10/5A

Features

- All models are molded from a UL940V-0 material with excellent resistance against flames and shocks.
- The terminal blocks can be mounted on DIN rail (35 mm wide).
- The 9.5mm wide marking strip can be used for all series and is wide enough to write many letters.
- Even when mounting terminal blocks of different current capacities side by side, no end plate is needed between terminal blocks
- Large capacity types (BN200 and BN400) are also available for direct mounting on panel surfaces.
- Double-Deck Terminal Blocks have terminals on 8.5mm centers
- Also available with a fuse.
- UL recognized and CSA certified.

UL Recognized File No. E78117

CSA Certified File No. LR64803

BN/BNH Series Parts List

Series	Terminal Style	Part No.	Rated Applicable Wire AWG (mm²)	Terminal Screw
Standard	Touch-Down Terminal	BNH15MW	22-14 (2)	M3
		BNH15LW	22-14 (2)	M3.5
		BNH30W	18-10 (5.5)	M4
		BNH50W	16-6 (22)	M5
	Screw Terminal	BN75W	16-4 (22)	M6
		BN150W	16-1/0 (60)	M8
Large Capacity (Note)	Stud Terminal	BN200NW☐	4/0 (100)	M10
		BN400NW☐	400 mcm (200)	M12
Large Capacity Panel Mount (Note)	Stud Terminal	BN200NW☐ K	4/0 (100)	M10
		BN400NW☐ K	400 mcm (200)	M12
With Fuse	Screw Terminal	BNF10	18-10 (5.5)	M4
		BF10S		
		BF10N		
Double-Deck Terminal Block	Touch-Down Terminal	BNDH15W	22-14 (2)	M3

Note: Specify 2 for 2-poles, 3 for 3-poles, 4 for 4-poles in place of ☐ in the Part No..

General Ratings

Insulation Voltage	600V
Dielectric Strength	2500V AC, 1 minute
Insulation Resistance	100MΩ minimum
Operating Temperature	-25 to +55°C
Operating Humidity	45 to 85% RH

UL & CSA Ratings

Part No.	Ratings	AWG
BN75W	600V/75A	16-4
BN150W	600V/150A	16-1/0
BNH15MW	600V/15A	22-14
BNH15LW	600V/15A	22-14
BNH30W	600V/30A	18-10
BNH50W	600V/50A	16-6
BNDH15W	600V/15A	22-14

Rated Current

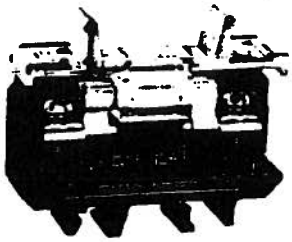
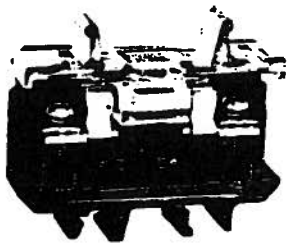
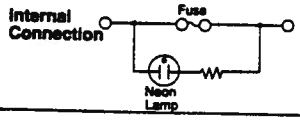
Rated current is not specified for each terminal block, because the current carrying capacity depends on the wire. Refer to the following table.

Rated Applicable Wire	Rated Current
16 AWG (1.25mm²)	10A
14 AWG (2)	15
12 (3.5)	20
10 (5.5)	30
6 (14)	50
4 (22)	75
0 (38)	100
00 (60)	150
0000 (100)	200
300 mcm (150)	300
400 mcm	350

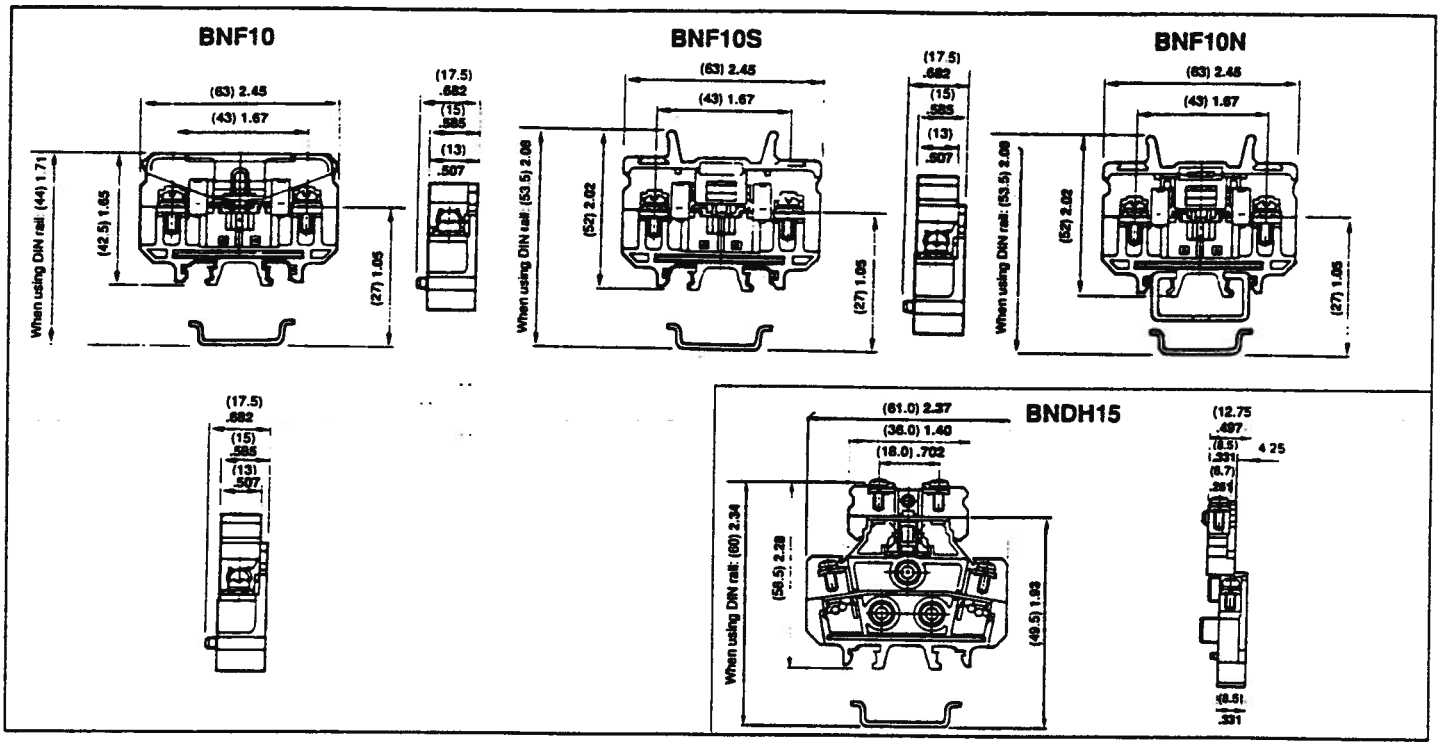
BN Series Selection Guide - Large Capacity Series

Part No.	BN200NW☐	BN400NW☐	BN200NW☐ K	BN400NW☐ K
Appearance				
Rated Current	200	350	200	350
Rated Applicable Wire Size Awg (mm²)	4/0 (100)	400 mcm (200)	4/0 (100)	400 mcm (200)
Terminal Type	Stud Terminal			
Terminal Screw	M10	M12	M10	M12
Applicable Socket Wrench	17mm Hex.	19mm Hex.	17mm Hex.	19mm Hex.
Dust Cover	BAC82, BAC820	BNC100, BNC1000	BAC82, BAC820	BNC100, BNC1000

BNF Series Selection Guide - Fuse Series

Part No.	BNF10		BNF10S		BNF10N (With Neon Lamp)	
	BNF10-5A	BNF10-10A	BNF10S-5A	BNF10S-10A	BNF10N-5A	BNF10N-10A
Appearance					 	
Fuse Type/Ratings	Cartridge Fuse: Ø 1/4 x 1-1/4 (6.35 x 31.8) Rated Voltage: 250V Rated Current: 5A, 10A					
Rated Applicable Wire Size Awg (mm²)	18-10 (5.5)		18-10 (5.5)		18-10 (5.5)	
Rated Current	5A	10A	5A	10A	5A	10A
Terminal Type	Self-Lifting Terminal w/Fuse				Self-Lifting Terminal w/Fuse & Lamp	
Terminal Screw	M4					
End Plate	BNE20					
DIN Rail	BAA					

Dimensions Dimensions in inches (mm).



Calculating Rail Length Dimensions in inches (mm).

To calculate the length for type BAA rail, use the following formula:

In inches:
$L_1 = 0.49 \times N$
$L_2 = L_1 - 0.98$

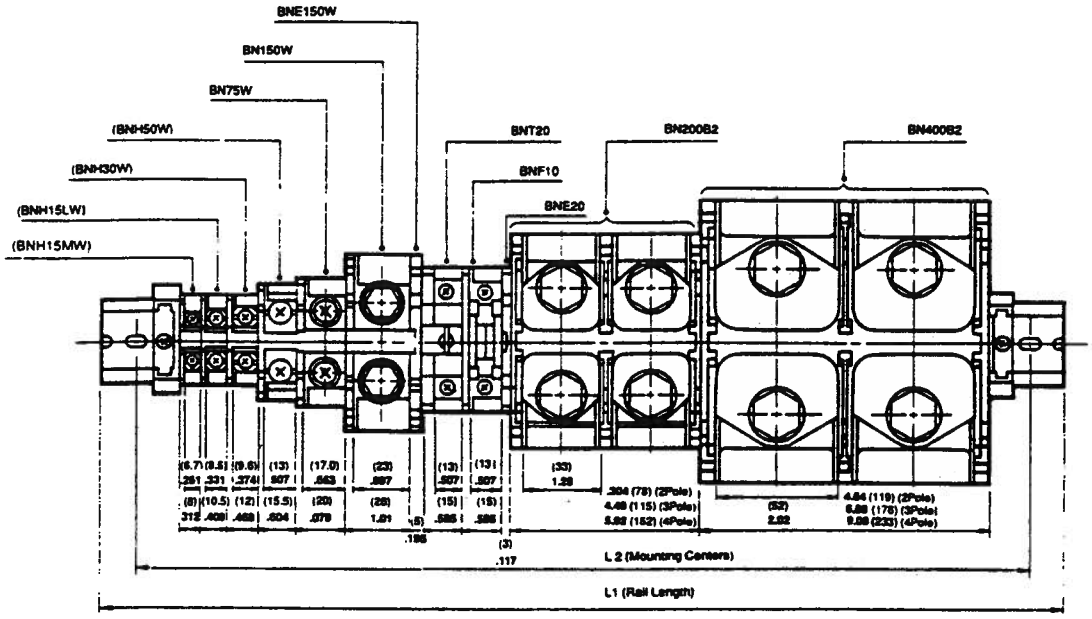
In mm:
$L_1 = 12.5 \times N$
$L_2 = L_1 - 25$

N : Integer raised the fraction from M
Example: N for 0.75 (19.1) is 0.78 (20)

In inches: $M = \dfrac{[A + 0.003]\, n + B + C}{0.49}$

In mm: $M = \dfrac{[A + (0.1)]\, n + B + C}{(12.5)}$

A = Thickness of each terminal block
B = Thickness of end plate
C = Thickness of mounting clip when used in pairs
BNL3: 2.38 (60.5)
BNL6: 2.20 (56.0)
BNL7: 2.46 (62.5)
BNL8: 2.63 (76.0)
n = The number of terminal blocks



ELECTRICAL COMPONENT

REFERENCE DWG #425-9001-01/9009

ITEM # 6

MANUFACTURER: ALLIED, 7440 PEBBLE DRIVE FT WORTH, TX 76118 800-433-5700

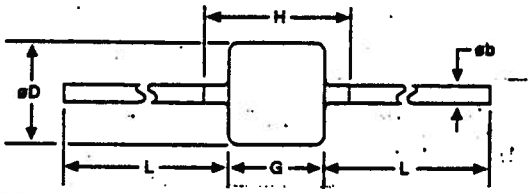
DESCRIPTION: METAL OXIDE VARISTOR

PART NUMBER: V39MA2A

Peak Pulse Current (Amps)	Energy (Joules)	Sizes/ Packages
250-500	1.5-5.0	22,20,16 Gauge
100-6500	0.4-160	5×8 10×16 14×22mm
40-100	0.07-1.7	3mm
25-4500	0.1-35	5 7 10 14 20mm
25-6500	0.4-160	5×8 10×16 14×22mm
1200-6500	11-360	7 10 14 20mm
6500	70-250	20mm
30000-40000	270-1050	40mm 40mm
50000-70000	450-10000	60mm
20000-70000	200-10000	32, 40, 60mm

MA Series – Axial Lead Varistors

All Harris MOVs Available at Allied Electronics.



SYMBOL	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
øb	0.024	0.026	.60	.66
øD	0.135	0.145	3.43	3.68
G	0.098	0.177	2.5	4.5
H	0.118	0.236	3.0	6.0
L	1.13	1.22	28.8	31.0

Typical Weight: 25 grams

11

Stock No.	Mfr.'s Type	Device Marking	Maximum Rating (75°C) Continuous RMS Voltage $V_{M(ac)}$ Volts	Continuous DC Voltage $V_{M(dc)}$ Volts	Transient Energy (10/100µs) W_M Joules	Transient Peak Current (8/20µs) I_M Amps	Characteristics (25°C) Varistor Voltage @1mA DC Test Current Min. Volts	Varistor Voltage @1mA DC Test Current $V_{M(dc)}$ Volts	Varistor Voltage @1mA DC Test Current Max. Volts	Maximum Clamping Voltage V_c@ I_p = 2 A Test Current (8/20 µs) V_c Volts	Typical Capacitance f =1MHz Picofarads
902-9500	V18MA1B	18B	10	14	0.07	40	15.0	18	21.0	44	550
902-9502	V22MA1B	22B	14	18	0.10	40	19.0	22	26.0	51	410
• 902-9504	V27MA1B	27B	17	22	0.11	40	24.0	27	31.0	59	370
902-9506	V33MA1A	33A	18	23	0.13	40	26.0	33	40.0	73	300
902-9508	V33MA1B	33B	20	26	0.15	40	29.5	33	36.5	67	300
902-9510	V39MA2A	39A	22	28	0.16	40	31.0	39	47.0	86	250
902-9512	V39MA2B	39B	26	31	0.18	40	35.0	39	43.0	79	250
902-9514	V24MA21	47A	27	34	0.19	40	37.0	47	57.0	99	210
902-9516	V47MA2B	47B	30	38	0.21	40	42.0	47	52.0	90	210
902-9518	V56MA2A	56A	32	40	0.23	40	44.0	56	68.0	117	180
902-9520	V56MA2B	56B	35	45	0.25	40	50.0	56	62.0	108	180
902-9522	V68MA3A	68A	38	48	0.26	40	54.0	68	82.0	138	150
902-9524	V68MA3B	68B	40	56	0.30	40	61.0	68	75.0	127	150
902-9526	V83MA3A	82A	45	60	0.33	40	65.0	82	99.0	163	120
902-9528	V82MA3B	82B	50	55	0.37	40	73.0	82	91.0	150	120
902-9530	V100MA41	100	57	72	0.40	40	80.0	100	120.0	200	100
902-9532	V100MA4B	101	60	81	0.45	40	90.0	100	110.0	185	100
902-9534	V120MA1A	120	72	97	0.40	100	102.0	120	138.0	220	40
902-9536	V120MA2B	121	75	101	0.50	100	108.0	120	132.0	205	40
902-9538	V150MA1A	150	88	121	0.50	100	127.0	150	173.0	255	32
902-9540	V150MA2B	151	92	127	0.60	100	135.0	150	165.0	240	32
902-9542	V180MA1A	180	105	144	0.60	100	153.0	180	207.0	310	27
902-9544	V180MA3B	181	110	152	0.70	100	162.0	180	198.0	290	27
902-9546	V220MA2A	220	132	181	0.80	100	187.0	220	253.0	380	21
902-9548	V220MA4B	221	138	191	0.90	100	198.0	220	242.0	360	21
902-9550	V270MA2A	270	163	224	0.90	100	229.0	270	311.0	460	17
902-9552	V270MA4B	271	171	235	1.00	100	243.0	270	297.0	440	17
902-9554	V330MA2A	330	188	257	1.00	100	280.0	330	380.0	470	14
902-9556	V330MA5B	331	200	274	1.10	100	297.0	330	363.0	540	14
902-9558	V390MA3A	390	234	322	1.20	100	331.0	390	449.0	670	12
902-9560	V390MA6B	391	242	223	1.30	100	351.0	390	429.0	640	12

ELECTRICAL COMPONENT 424-9001-01/9001
REFERENCE DWG # 425-9001-01/9002
ITEM # 7, 22, 23, 211, 317
MANUFACTURER: SUBCONN, 40 WESTERN WAY DUXBURY, MA 02331 617-934-0719
DESCRIPTION: CONNECTOR W/ LOCKING SLEEVE
PART NUMBER: BH12F w DLSC-F
BH6F w DLSB-F
1L6M w DLSB-M
1L16M w DLSC-M
1L12M w DLSC-M

SPECIFICATIONS

SUBCONN® STANDARD AND LP SERIES

CONTACT RATING	:	750 V – 15 amp
CONTACT RESISTANCE	:	< 0.01 ohm
INSULATION RESISTANCE	:	> 200 Megohm after wet mating
HI POT TEST VOLTAGE	:	2,500 V AC
DEPTH RATING	:	20,000 P.S.I.–1,400 bar
MATING CYCLES	:	> 500 wet matings

MATERIALS

STANDARD AND LP SERIES

CONNECTOR BODY	:	Neoprene	
BULKHEAD BODY	:	Brass	– standard
		316 SS	– optional
		Cu. Al. Br.	– optional
ELECTRICAL CONTACTS	:	Brass	– standard
		Gold plated brass	– optional
LOCATION PIN	:	303 SS	– standard
BULKHEAD 'O' RINGS	:	Nitrile	
IN-LINE CABLE 2 ft.	:	16 AWG or 18 AWG	
BULKHEAD PIGTAILS 1 ft.	:	16 AWG rubber or 18 AWG teflon	
LOCKING SLEEVES	:	Delrin	– standard
		Brass	– optional
		Stainless Steel	– optional
LOCKING SLEEVE SNAP RING	:	303 SS (Stainless Steel)	

OPTIONS

The following standard options are available:

— Additional in-line cable – standard 2 ft.
— Longer bulkhead leads – standard 1 ft.
— Teflon wire on all bulkhead connectors

FOR INSTALLATION OF OM CONNECTORS

NEOPRENE BOOTS

OMBM	Boot for 2 contact mini
OMBA	Boot for 2, 3 & 4 contact
OMBB	Boot for 6, 8 & 12 contact

FIELD INSTALLATION KIT

MOLDING MATERIAL – PRE-PACKED

CCPU 3.5 oz.	Polyurethane cold (1 molding)
CCPU 8 oz.	Polyurethane cold cure (2-3 moldings)

PRIMER

PR M 10	Metal primer 10 ml.
PR P 10	Neoprene/polyurethane 10 ml.

HANDLING PROCEDURES

— Lubricate with silicone spray, or grease male connector with very light coating.

— Connectors should not be allowed to "dry out" by long exposure to heat or sunshine. If this occurs soak in water before use.

— Avoid accumulation of sand or mud which can "splay" the female contact.

— Connectors are best cleaned with warm soapy water. They do not have to be dried. Avoid the use of chemical cleaners.

— Do not overtighten the bulkhead nuts.

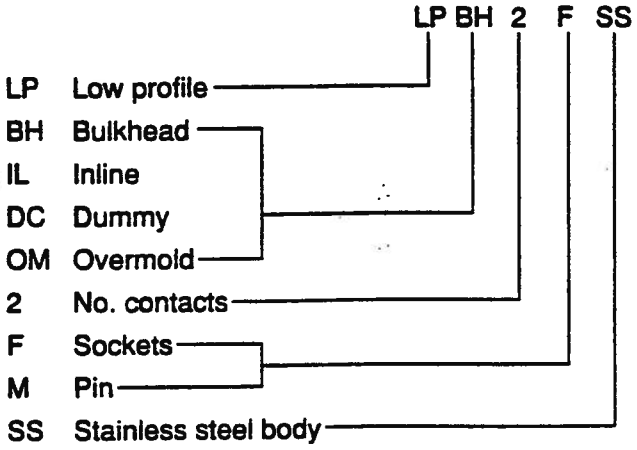
— Do not disconnect by pulling on cable.

— Avoid sharp bends at cable entry

SUBCONN® NUMBER CODING

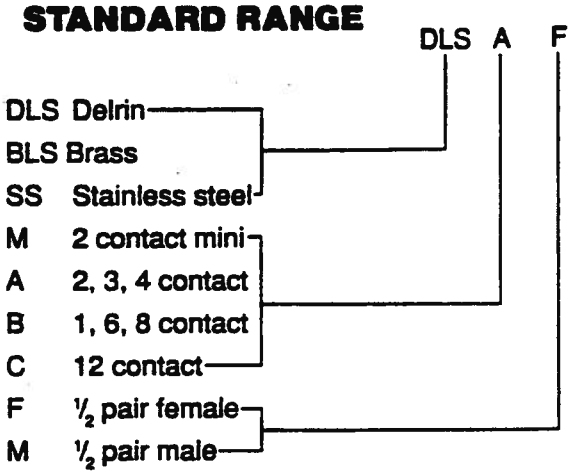
We have tried to keep our code numbering system as simple as possible. The following codes cover all the standard products and cross reference with the drawings. Any special requests, such as a changed thread size, should be noted after the code.

CONNECTORS



Above configuration denotes low profile, two pin female bulkhead with stainless steel bulkhead body.
Please note nut and washer sets for bulkhead connectors are *not* included with the connector and should be ordered separately.

LOCKING SLEEVES– STANDARD RANGE



Above configuration denotes delrin locking sleeve for 2, 3 or 4 contact, female (inside thread) half including snap ring.

WIRE CODING

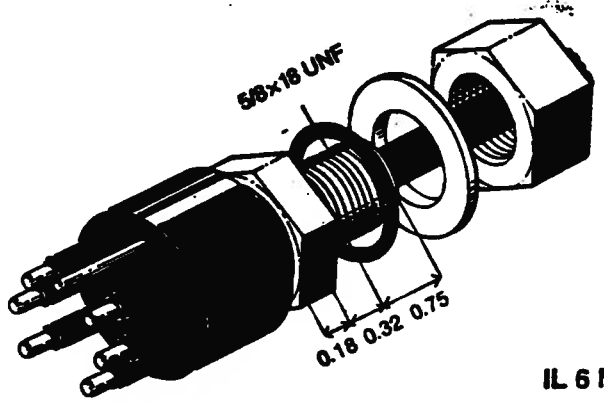
The SO standard cable used on the in-line connectors is coded as follows:

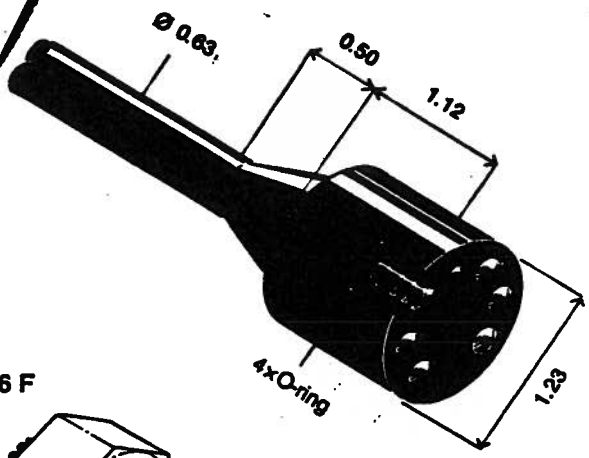
CONTACT	COLOR
1	Black
2	White
3	Red
4	Green
5	Orange
6	Blue
7	White/black
8	Red/black
9	Green/black
10	Orange/black
11	Blue/black
12	Black/white

The bulkhead leads are tagged with pin number.

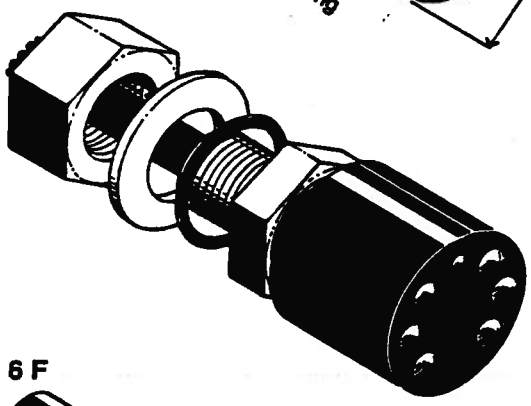
STANDARD 6-CONTACT CONNECTORS

BH 6 M

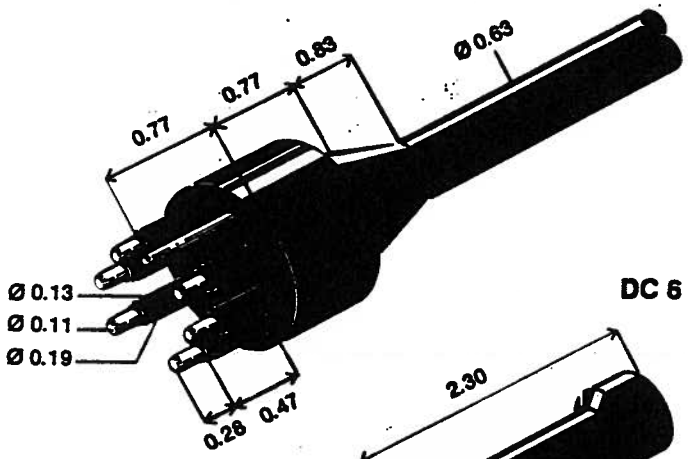




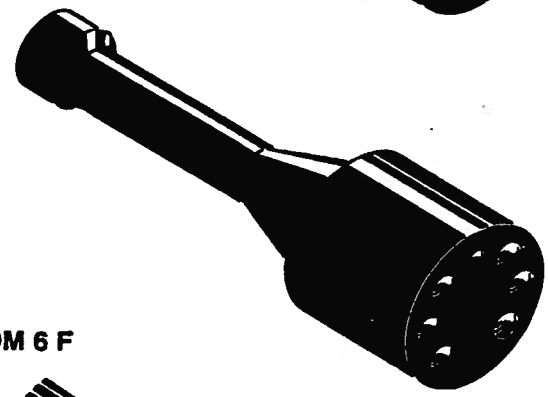
BH 6 F



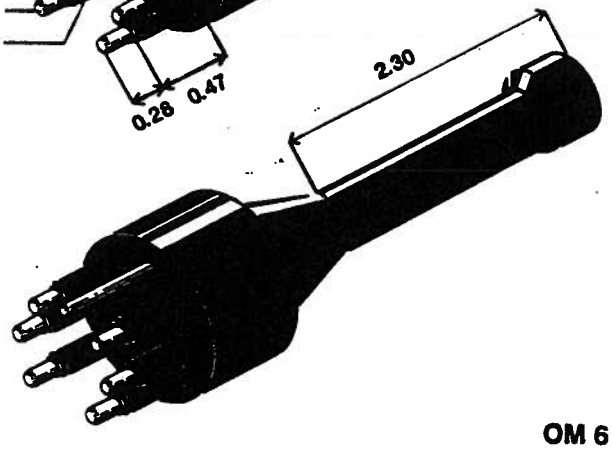
IL 6 M



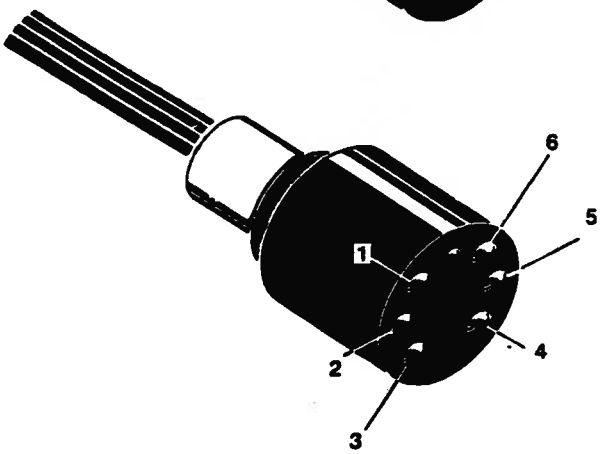
DC 6 F



DC 6 M



OM 6 F



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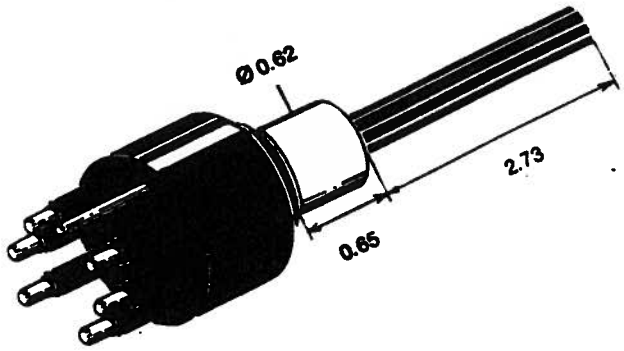
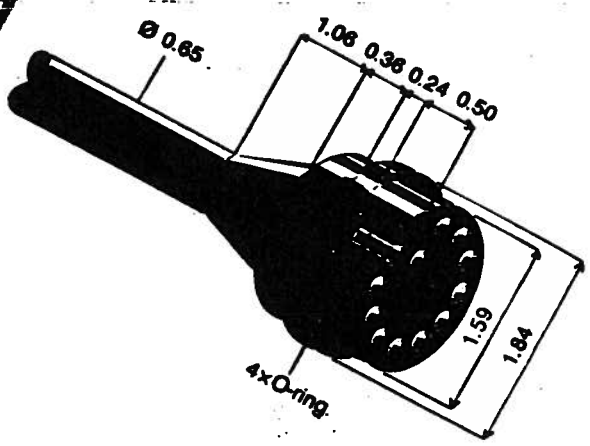
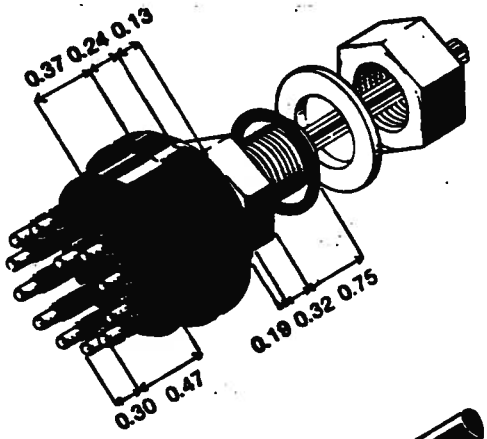


STANDARD 12-CONTACT CONNECTORS

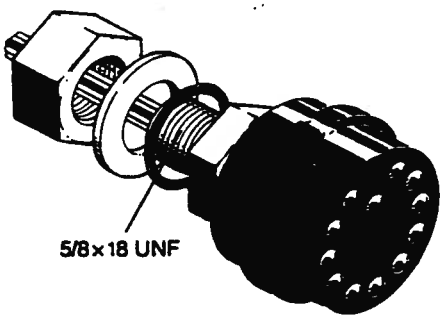
BH 12 M





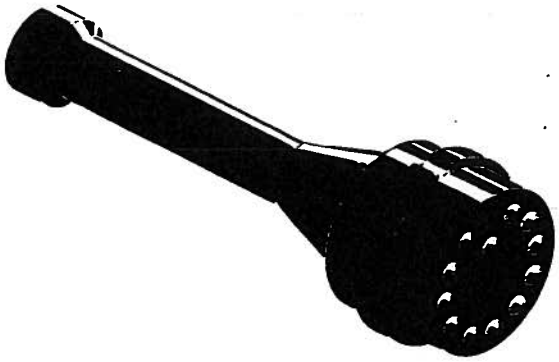
IL 12 M

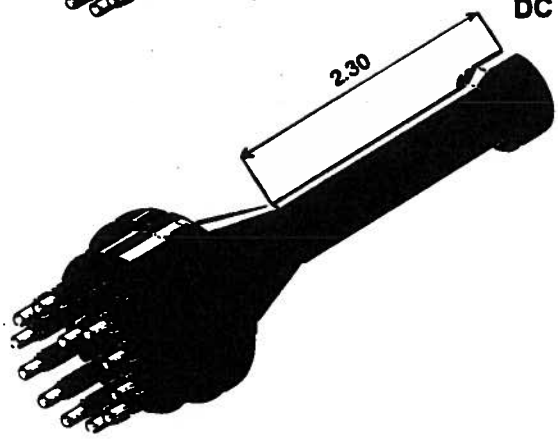
BH 12 F



DC 12 M

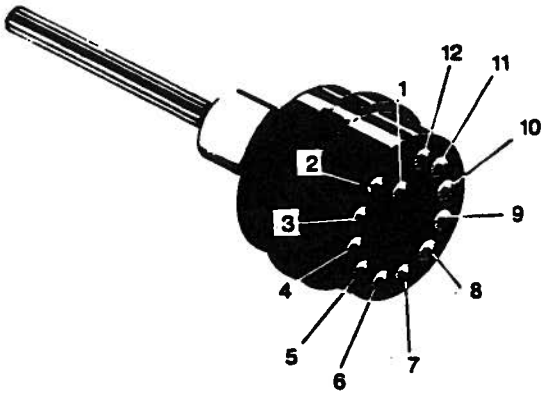
DC 12 F

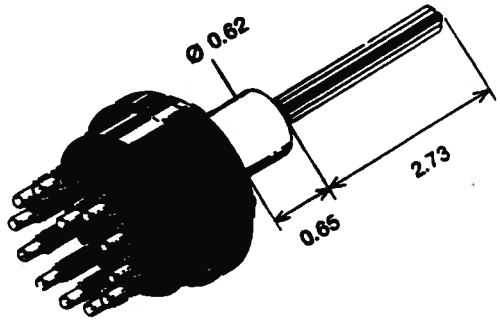




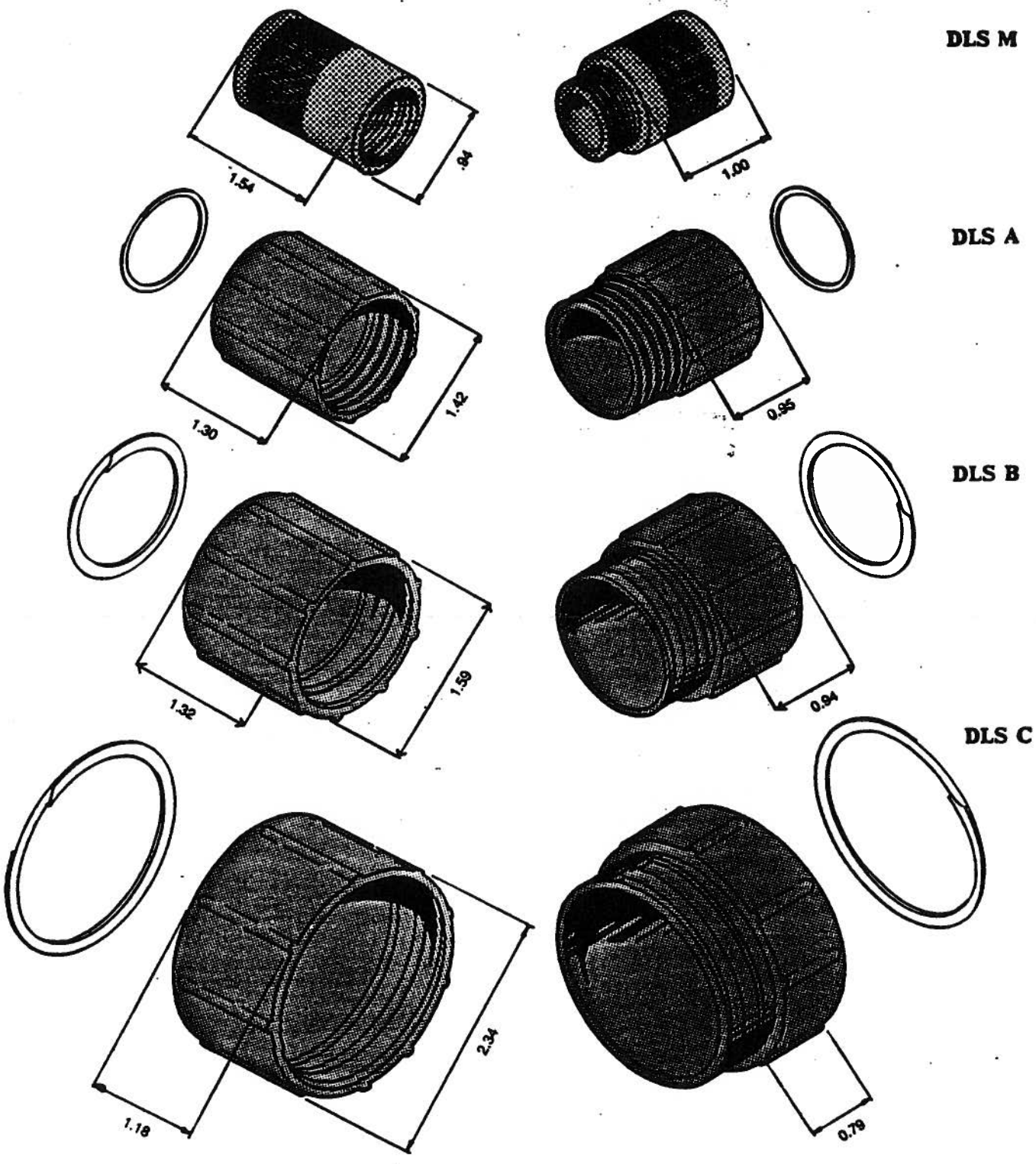
OM 12 M

OM 12 F





STANDARD DELRIN LOCKING SLEEVES



ELECTRICAL COMPONENT

REFERENCE DWG #425-9001-01/9009

ITEM # 26, 211

MANUFACTURER: SUBCONN, 40 WESTERN AV, DUXBURY, MA 02331 617-934-0719

DESCRIPTION: CONNECTOR w/ LOCKING SLEEVE

PART NUMBER: BH16F w/ DLSC-M
IL16M w/ DLSC-M

Subconn® Underwater

2.0 The product Range

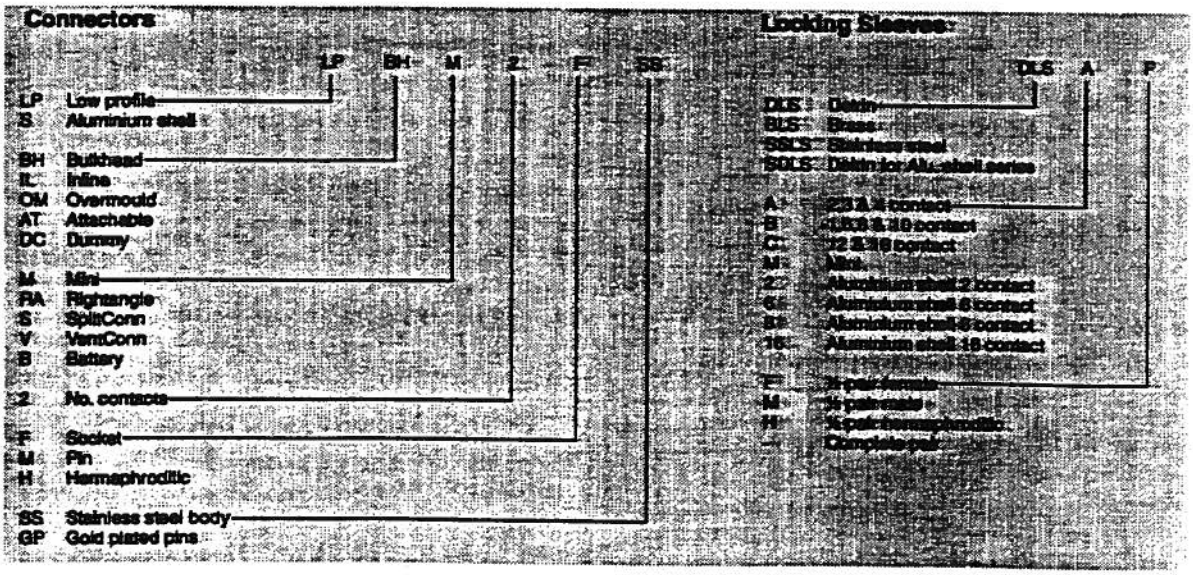
The Subconn® product range can be divided in to 5 groups as indicated in the index.

- Standard Circular series with up to 16 contacts
- Standard Low Profile series with up to 9 contacts
- Aluminium Shell series with up to 16 contacts
- Power connectors for welding, single & three phase power
- Hermaphroditic, SplitConn, Reed switches & AddConn connectors
- NiAlBr Metal Shell military standard connectors (eg. mine systems)

3.0 Ordering information

In order to simplify enquiries and the ordering of connectors we have included drawings and code numbers of all the currently available connectors. There are, however, a number of options available and these should be noted with any enquiry or purchase order. These include:

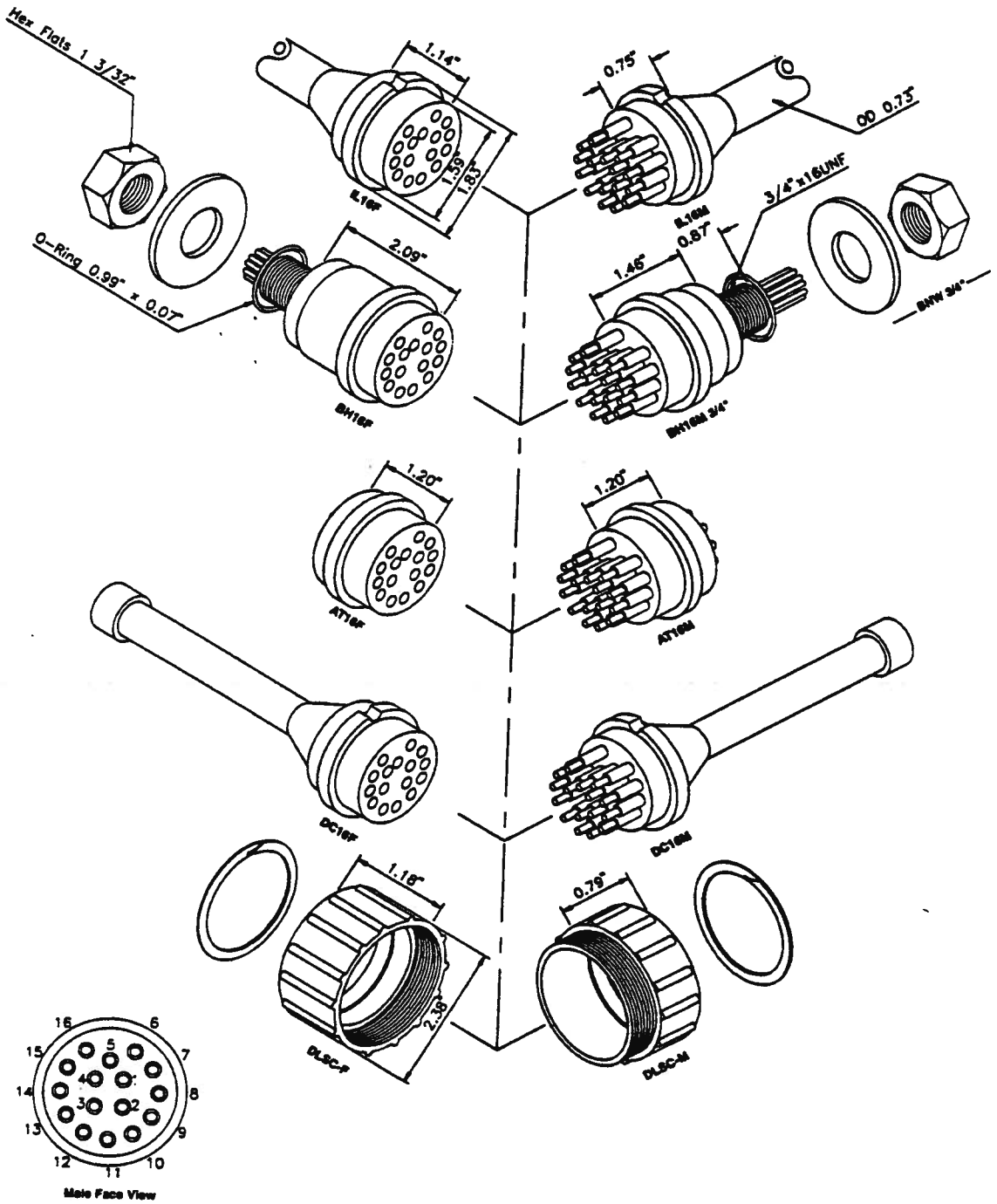
- Non standard in-line cable or bulkhead lead length
- Special cable requirements
- Gold plated mil. spec. contacts
- Nut & washer sets for bulkhead connectors
- Stainless steel AISI 316, NIAlBr & titanium bulkhead bodies
- Brass, stainless steel & titanium locking sleeves
- Non standard bulkhead threads & lengths
- Special harness cable requirements including penetrators
- Stress terminations to electro-mechanical cables
- Certified electrical, pressure & stress tests
- Specially engineered connectors based on the Subconn® principle



The standard Subconn® connector is manufactured from high grade neoprene with naval brass contacts and bulkhead bodies, SO neoprene cable and teflon insulated bulkhead

SUBCONN® UNDERWATER PLUGGABLE ELECTRICAL CONNECTORS

STANDARD 16 CONTACT CIRCULAR



Standard Inline Cable Color Code

1 Black	9 Green/Black
2 White	10 Orange/Black
3 Red	11 Blue/Black
4 Green	12 Black/White
5 Orange	13 Red/White
6 Blue	14 Green/White
7 White/Black	15 Blue/White
8 Red/Black	16 Black/Red

(Bulkhead Leads Number Tagged)

Connector Specification

Contact Rating	: 600 V @ 15 Amp
Contact Rating 2-4 pins	: 600 V @ 10 Amp
Contact Rating 5-10 pins	: 600 V @ 6 Amp
Contact Rating 12-16 pins	: 600 V @ 5 Amp
Insulation Resistance	: >200 megaohm
Contact Resistance	: <0.01 ohm
Hi Pot Test	: 2,500 V AC
Wet Matings	: >500
Temp. Rating	: 24 to 140 degr. F.
Depth Rating	: 1,400 bar - 20,000 psi

Standard Material Specification

Connector Body	: Neoprene
Bulkhead Body	: Naval Brass
Contacts	: Naval Brass
Location pin	: 303SS
'O' Rings	: Nitrile
Locking Sleeve	: Delrin
Snap Ring	: 303SS
Inline Cable (60 cm)	: 16 AWG 1.34 mm² neopr. (2-9 pin) : 18 AWG 1.0 mm² neopr. (10-16 pin-mini)
BH Leads (30 cm)	: 18 AWG 1.0 mm² teflon
Options	: See section 3.0

Dimensions in inches.

1 inch = 25.4 mm.

Drawing No. SE 400-10

Rev: -

10/94

For Orders and Information Contact: Tel. 617/934-0719 Fax 617/934-0699
40 Western Way, P.O. Box 68, Duxbury, MA 02331 USA

MacArtney Inc.
Underwater Technology

ELECTRICAL COMPONENT

REFERENCE DWG #425-9001-01/9009-0

ITEM # 11-15, 32, 33

MANUFACTURER: IDEC, 1213 ELKO DRIVE. SUNNYVALE, CA 94089-2 408-747-0550

DESCRIPTION: RELAY WITH SOCKET

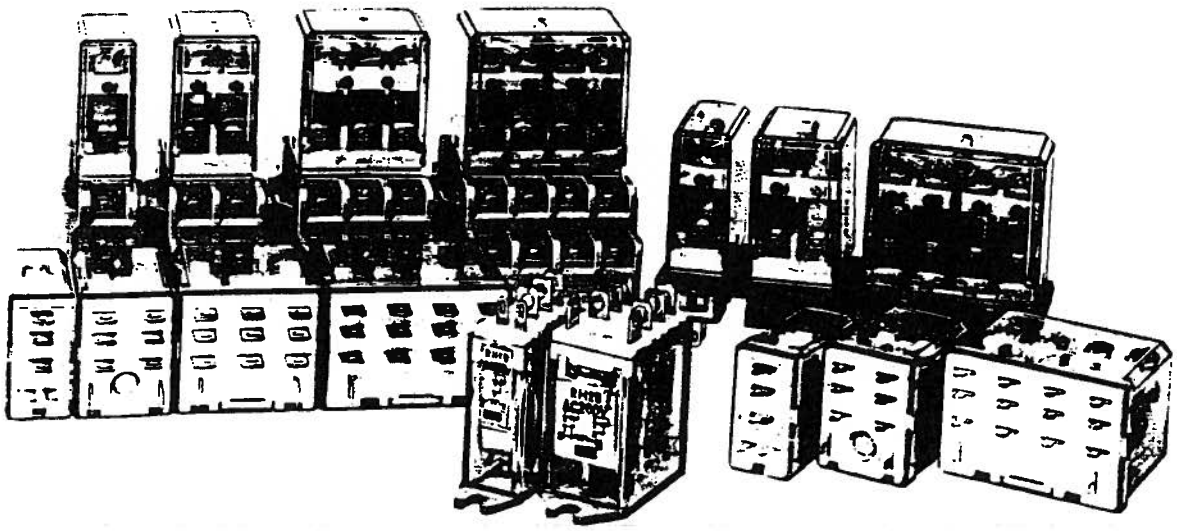
PART NUMBER: RH3B-UL-DC12V w/SH3B

Specifications

Contact Material	Silver cadmium oxide (AgCdO)
Contact Res.	50mΩ max. (Initial value)
Minimum Applicable Load	24V DC/30mA, 5V DC/100mA (reference value)
Operating Time	SPDT(RH1), DPDT (RH2): 20ms max. 3PDT (RH3), 4PDT (RH4): 25ms max.
Release Time	SPDT(RH1), DPDT (RH2): 20ms max. 3PDT (RH3), 4PDT (RH4): 25ms max.
Power Consumption	SPDT (RH1): DC: 0.8W AC: 1.1VA (50Hz), 1VA (60Hz) DPDT (RH2): DC: 0.9W AC: 1.4VA (50Hz), 1.2VA (60Hz) 3PDT (RH3): DC: 1.5W AC: 2VA (50Hz), 1.7VA (60Hz) 4PDT (RH4): DC: 1.5W AC: 2.5VA (50Hz), 2VA (60Hz)
Insulation Resistance	100MΩ min (measured with a 500V DC megger)
Dielectric Strength	SPDT (RH1) Betw. live and dead parts: 2000V AC. 1 minute: Betw. contact circuit and operating coil: 2000V AC. 1 minute: Between contacts of the same pole: 1000V AC. 1 minute
	DPDT (RH2), 3PDT (RH3), 4PDT (RH4) Betw. live and dead parts: 2000V AC. 1 minute: Betw. contact circuit and operating coil: 2000V AC. 1 minute: Between contact circuits: 2000V AC. 1 minute: Between contacts of the same pole: 1000V AC. 1 minute
Freq. Response	1800 operations/hr
Temperature Rise	Coil: 85°C max. Contact: 65°C max.
Vibration Resistance	0 to 6G (55Hz max.)
Shock Resistance	SPDT/DPDT: 200N (approx. 20G) 3PDT/4PDT: 100N (approx. 10G)
Life Expectancy	Electrical: over 500,000 operations at 120V AC, 10A; (over 200,000 operations at 120V AC, 10A for SPDT (RH1), 3PDT (RH3), 4PDT (RH4). Mecnanical: 50,000,000 operations
Operating Temp.	-30° to +70°C
Weight	SPDT: 24g, DPDT: 37g (approx.) 3PDT: 50g, 4PDT: 74g (approx.)

Termination	Contact Configuration	Basic Part No.	Basic Part No. w/ Indicator Light	Basic Part No. w/ Check Button	Basic Part No. w/ Indicator Light & Check Button	Basic Part No. w/ Top Bracket
B (Blade)	SPDT	RH1B-U				RH1B-UT
	DPDT	RH2B-U	RH2B-UL	RH2B-UC	RH2B-ULC	RH2B-UT
	3PDT	RH3B-U	RH3B-UL	RH3B-UC	RH3B-ULC	RH3B-UT
	4PDT	RH4B-U	RH4B-UL	RH4B-UC	RH4B-ULC	RH4B-UT

MIDGET POWER TYPE RELAYS
LARGE CAPACITY 10AMP-1, 2, 3, and 4 POLES



UL Recognized
File No. E67770
E59804
E64245

CSA Certified
File No. LR35144

GENERAL

IDEC's Midget Power RH relays are similar to our general purpose RR series relays with full 10 amp switching capacity. Compact in size, the RH series relays reduce space requirements which are an important feature in todays downsized equipment.

RH Midget Power relays are available in SPDT, DPDT, 3PDT and 4PDT contact configurations driven by AC or DC coils with a choice of either blade or PCB mount .078 inch(2mm) terminals. Top bracket mounting is available for SPDT, DPDT and 4PDT terminal blade models.

FEATURES

- Miniature size package allows compact system designing.
- 10 amp contact capacity.
- Dielectric strength—up to 2,000 volts.
- UL recognized and CSA certified.
- Indicator light or check button available on 2, 3 and 4-pole models.
- Complete accessories include IDEC's broad line of sockets, hold-down springs and mounting rails.

TYPE LIST

Terminal Style	Contact Configuration	Basic Type	With Indicator Light	With Check Button	Top Bracket Mounting Type
B (Blade)	SPDT	RH1B-U	—	—	RH1B-UT
	DPDT	RH2B-U	RH2B-UL	RH2B-UC	RH2B-UT
	3PDT	RH3B-U	RH3B-UL	RH3B-UC	—
	4PDT	RH4B-U	RH4B-UL	RH4B-UC	RH4B-UT
V2 (PCB 0.078" wide)	SPDT	RH1V2-U	—	—	—
	DPDT	RH2V2-U	RH2V2-UL	RH2V2-UC	—
	3PDT	RH3V2-U	RH3V2-UL	RH3V2-UC	—
	4PDT	RH4V2-U	RH4V2-UL	RH4V2-UC	—

idec RH SERIES MIDGET POWER/GENERAL PURPOSE

SPECIFICATIONS

Contact Material	Silver cadmium oxide (Ag-CdO)
Contact Resistance	50 mΩ max. (initial value)
Operate Time	SPDT(RH1), DPDT(RH2) . . . 20 msec max., 3PDT(RH3), 4PDT(RH4) . . . 25 msec max.
Release Time	SPDT(RH1), DPDT(RH2) . . . 20 msec max., 3PDT(RH3), 4PDT(RH4) . . . 25 msec max.
Power Consumption (Approx.)	SPDT(RH1) . . . AC: 1.1 VA (50 Hz), 1 VA (60 Hz), DC: 0.8W DPDT(RH2) . . . AC: 1.4 VA (50 Hz), 1.2 VA (60 Hz), DC: 0.9W 3PDT(RH3) . . . AC: 2 VA (50 Hz), 1.7 VA (60 Hz), DC: 1.5W 4PDT(RH4) . . . AC: 2.5 VA (50 Hz), 2 VA (60 Hz), DC: 1.5W
Insulation Resistance	100 MΩ min. (measured at 500V DC megger)
Dielectric Strength	SPDT(RH1) Between live and non-live parts: 2000V AC, 1 minute Between contact circuit and operating coil: 2000V AC, 1 minute Between contacts of the same pole: 1000V AC, 1 minute DPDT(RH2), 3PDT(RH3), 4PDT(RH4) Between live and non-live parts: 2000V AC, 1 minute Between contact circuit and operating coil: 2000V AC, 1 minute Between contact circuits: 1500V AC, 1 minute Between contacts of the same pole: 1000V AC, 1 minute
Frequency Response	1800 operations/hour
Temperature Rise	Coil: 85 deg. max., Contact: 65 deg. max.
Vibration Resistance	0 to 6g (55 Hz max.)
Shock Resistance	SPDT(RH1), DPDT(RH2) . . . 20g, 3PDT(RH3), 4PDT(RH4) . . . 10g
Operating Temperature	-22° to +158°F (-30°C to +70°C)
Weight (Approx.)	RH1: 24g, RH2: 37g, RH3: 50g, RH4: 74g
Life Expectancy	Electrical: 500,000 operations or more (120V AC, 10A)* Mechanical: 50,000,000 operations or more

Note:* 200,000 operations or more (120V AC, 10A) in SPDT(RH1), 3PDT(RH3), 4PDT(RH4) types.

COIL RATINGS

Rated Voltage (V)		Rated Current (mA) ±15% at 20°C								Coil Resistance (Ω) ±10% at 20°C				Continuous Applied Voltage (Max.) 20°C	Pick up Voltage (min.) at 20°C
		60 Hz				50 Hz									
		SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT		
AC	6V	150	200	280	330	170	238	330	387	18.8	9.6	6.0	5.4	110% of rated voltage without overheating	80% of rated voltage
	12V	75	100	140	165	86	118	165	196	76.8	40.5	25.3	21.2		
	24V	37	50	70	83	42	59.7	81	98	300	156.7	103	84.5		
	120V	7.5	11	14.2	16.5	8.6	12.9	16.4	19.5	7680	4280	2770	2220		
	*240V	—	5.5	7.1	8.3	—	6.5	8.2	9.8	—	15720	12110	9120		
DC		SPDT		DPDT		3PDT		4PDT		SPDT	DPDT	3PDT	4PDT	110% of rated voltage without overheating	80% of rated voltage
	6V	128		150		240		250		47	40	25	24		
	12V	64		75		120		125		188	160	100	96		
	24V	32		36.9		60		62		750	650	400	388		
	48V	18		18.5		30		31		2600	2600	1600	1550		
	*110V	8.0		9.1		12.8		15		13800	12100	8600	7340		

Note: Rated voltages marked with * are not available for SPDT models.

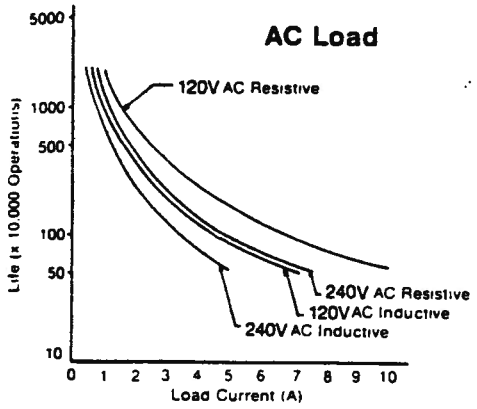
CONTACT RATING UL RATINGS (RH1, RH2, RH3, RH4)

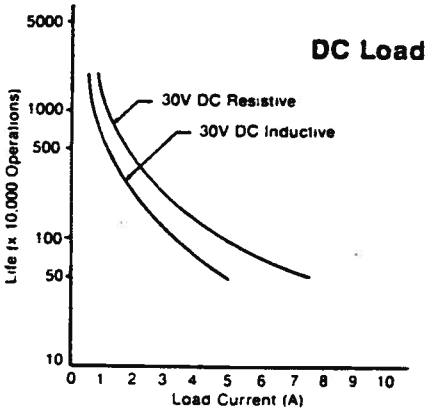
VOLTAGE (V)	RESISTIVE (A)				INDUCTIVE (A)				HORSE POWER	
									SPDT	
	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	DPDT	3PDT
120 AC	—	—	10	10	7	7	—	7.5	1/6	1/6
240 AC	10	10	—	7.5	7	7	6.5A/Pole 20A Total	5	1/3	1/3
30 DC	10	10	10	—	7	7	—	—	—	—

A RATINGS (RH1, RH2, RH3, RH4)

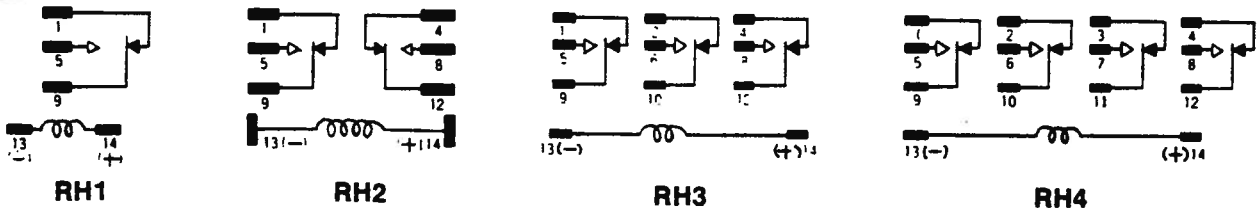
VOLTAGE (V)	RESISTIVE (A)				INDUCTIVE (A)				HORSE POWER		
	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT
120 AC	10	10	10	10	7.5	7.5	–	7.5	1/6	1/6	1/6
240 AC	10	10	–	7.5	7	7	7	5	1/3	1/3	1/3
30 DC	10	10	10	10	7	7.5	–	–	–	–	–

ELECTRICAL LIFE (RH2)





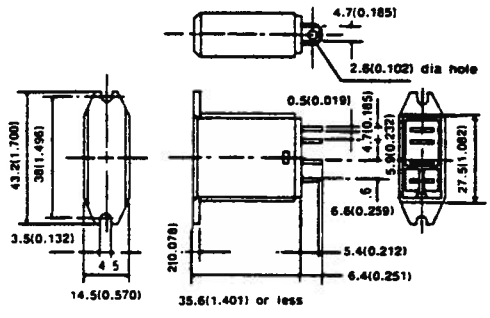
CIRCUIT DIAGRAM



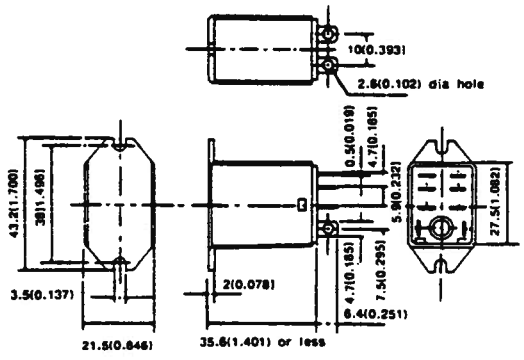
RELAY DIMENSIONS

TOP BRACKET MOUNTING TYPE (Blade Terminal)

RH1B-UT



RH2B-UT



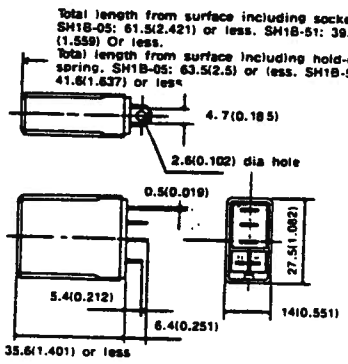
All dimensions indicated in millimeters. ( ) indicate inches

idec RH SERIES MIDGET POWER/GENERAL PURPOSE

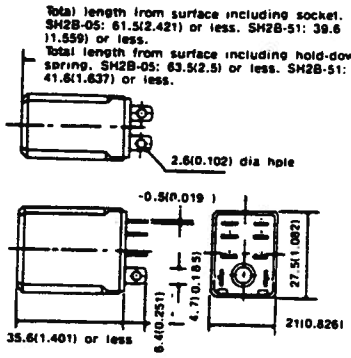
RELAY DIMENSIONS

PLUG-IN TYPE (Blade Terminal)

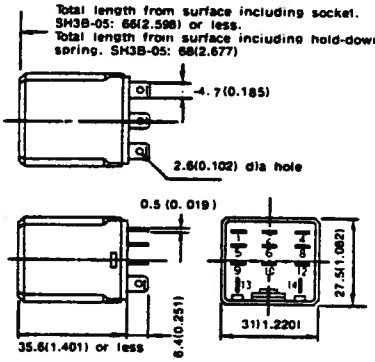
RH1B



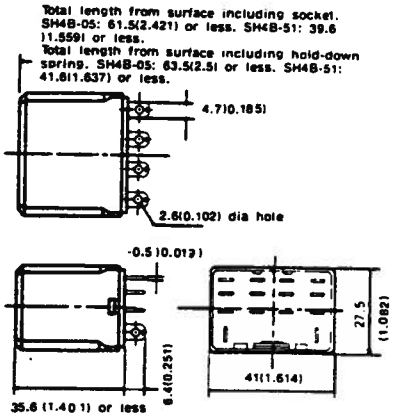
RH2B



RH3B

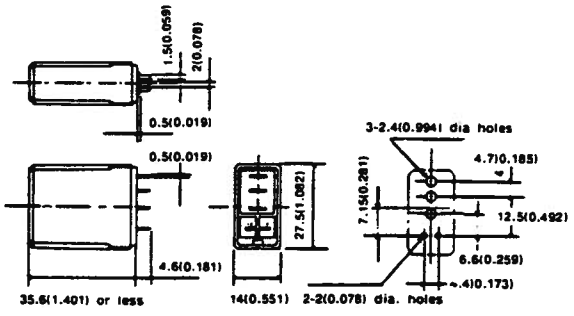


RH4B

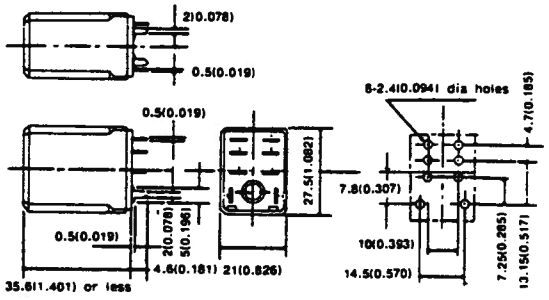


P.C. BOARD TERMINAL TYPE

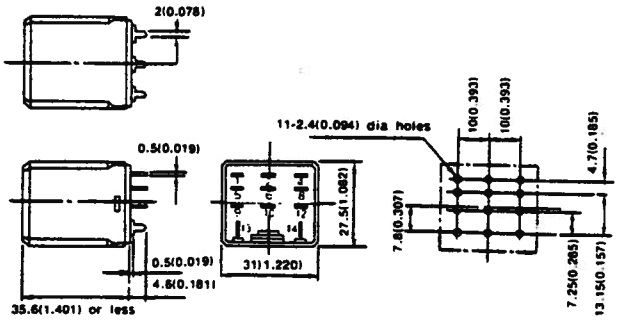
RH1V2



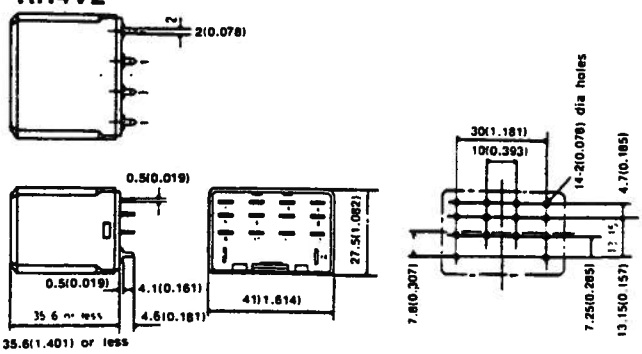
RH2V2



RH3V2



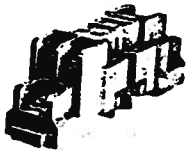
RH4V2

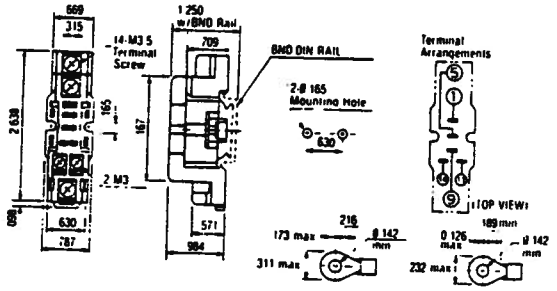


SNAP-MOUNT SOCKETS
SH SERIES SOCKETS

• SH1B-05

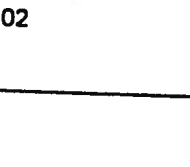
Type: Blade, Snap-Mount/surface mount
Terminal: (Coil) M3 screws/(Contact) M3.5 screws w/captive wire clamp
Wire Size: Max. up to 2-#12 AWG
Electrical Rating: 250V, 10A
Relay No.: RH1B, RHN1B, RAHB, RBHB
Hold-Down Spring: SY2S-02F1, SFA-101, SFA-202

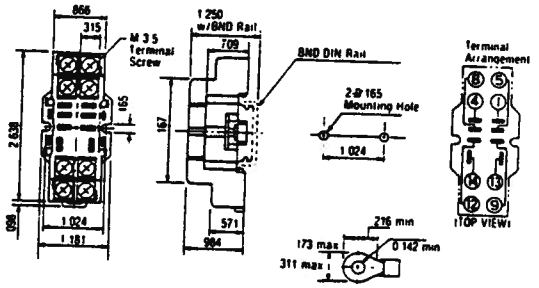




• SH2B-05

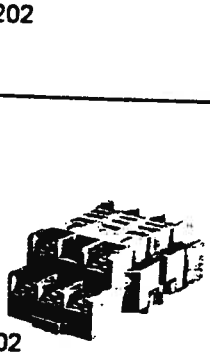
Type: Blade, Snap-Mount/surface mount
Terminal: M3.5 screws w/captive wire clamp
Wire Size: Max. up to 2-#12 AWG
Electrical Rating: 250V, 10A
Relay No.: RH2B, RAMB, RBMB
Hold-Down Spring: SY4S-02F1, SFA-101, SFA-202

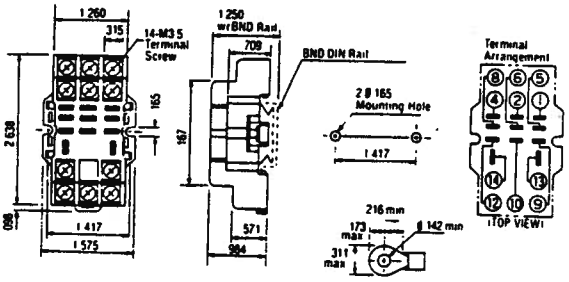




• SH3B-05

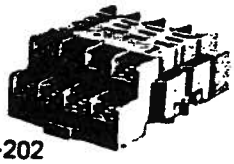
Type: Blade, Snap-Mount/surface mount
Terminal: M3.5 screws w/captive wire clamp
Wire Size: Max. up to 2-#12 AWG
Electrical Rating: 250V, 10A
Relay No.: RH3B, *RH2LB
Hold-Down Spring: SH3B-05F1, SFA-101, SFA-202
(*Latching type relay)

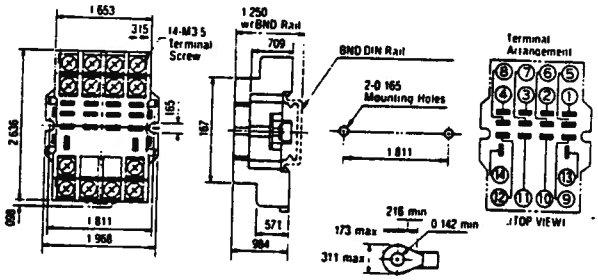




• SH4B-05

Type: Blade, Snap-Mount/surface mount
Terminal: M3.5 screws w/captive wire clamp
Wire Size: Max. up to 2-#12 AWG
Electrical Rating: 250V, 10A
Relay No.: RH4B
Hold-Down Spring: SH4B-02F1, SFA-101, SFA-202





Dimensions indicated in inches

SY SERIES SNAP-MOUNT SOCKETS: SEE NEXT PAGE

ELECTRICAL COMPONENT 424-9001-01/9002

REFERENCE DWG #425-9001-01/9002

ITEM # 29, 30, 312, 313

MANUFACTURER: FURNAS, 1000 MCKEE STREET BATAVIA, ILL 60510 708-879-6000

DESCRIPTION: PUSHBUTTON OPERATOR

PART NUMBER: 52PA8 W 52BAK & 52AABA

Push Button

Color	Flush Cap Cat No	⅜" Extended Cap Cat No
Black	52PA8A1	52PA8B1
Red	52PA8A2	52PA8B2
Green	52PA8A3	52PA8B3
Less Cap	52PA8	52PA8

Actuator Cap

Color	Cat No
Black	52RA1A1
Red	52RA1A2
Green	52RA1A3
Yellow	52RA1A4
Blue	52RA1A5
Gray	52RA1A6
Brown	52RA1A7
Orange	52RA1A8

Mushroom Head

Color	1⅝" Head Cat No	Price	2½" Head Cat No
Red	52PB9D2	$34.20	52PB9E2
Less Head	52PB9	28.20	52PB9

Mushroom Head Only

Color	Cat No	Price	Cat No
Black	52RB3D1	6.00	52RB3E1
Red	52RB3D2	6.00	52RB3E2
Green	52RB3D3	6.00	52RB3E3
Yellow	52RB3D4	6.00	52RB3E4
Blue	52RB3D5	6.00	52RB3E5
Gray	52RB3D6	6.00	52RB3E6
Brown	52RB3D7	6.00	52RB3E7
Orange	52RB3D8	6.00	52RB3E8

Contact Blocks

NEMA Rating	Contacts	Cat No
Q300 (DC SPDT)	NO	52BAK
Q600 (DC SPST)	NC	52BAJ
A600 (AC)	NO-NC (SPDT)	52BJK
8 max/operator	NO (Early Make)	52BAH
	Early make contact block closes before 52BAK.	
	NC (Late Break)	52BAE
	Late Break contact block opens after 52BAJ.	

Suitable for use on low energy level circuits. Hermetically sealed.

Logic Reed Switch	NO-NC (SPDT)	52BAR
	.5 Amp, 200VAC	
	10 Watt Max Resistive Load Only	

UL Listed For Class 1 Division 2.

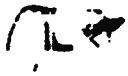
Ordering Instructions

- For other colored operators, add last 2 digits of color cap.
  Example: Yellow Flush Button: 52PA8A4 (A4 indicates 52RA1A4 Color Cap).
  Example: Green Mushroom Head: 52PB9D3 (D3 indicates 52RB3D3 Head).
- Contact blocks are ordered separately.
- Legend Plates page E33.
- Lens guard page E26.
- Accessories page E32

Pilot Devices
Oil Tight

■ Accessories
■ Replacement Lamps

Accessories

			Cat No
Clear Protective Boot		Boot covers the flush or raised push button operator so that ice or other foreign substances cannot interfere with button operation.	52AABA
Push Button Guard		Prevents accidental operation of the push button and requires operation to be premeditated. Fits any push button. Push button guard, when installed, provides a recess of ½" on a flush push button operator.	52AAGP
Guard for Mushroom Head		For 1⅝" mushroom head. If guards are required on adjacent buttons, additional hole spacing is required. Can be used on push-pull devices.	52AAGM
Padlock Attachment		Fits flush push button. Fits raised push button.	52AALA 52AALB
Padlock Cover		Fits push button selector operator illuminated and non illuminated mushroom heads. Can be used to lock these devices in the off position.	52AALS
Lock Nut Wrench		For tightening lock nuts on all oil tight push buttons, selector switches, pilot lights.	Class 52 and BJ Type: 52MAWB Class 52 Automotive and Compact Type: 52MAWA
Hole Plug		Provides oil tight seal for unused mounting holes in stations.	Corrosion Resistant Steel, Gray: 52AAH6 Steel, Gray: 52ABH6 Stainless Steel: 52ABHS
Spare Keys			501CH (1 Key): D28671015
Grounding Kit		Provides grounding for all Class 52 when used in plastic enclosures.	Grounding Ring: 52AL109145

Replacement Lamps

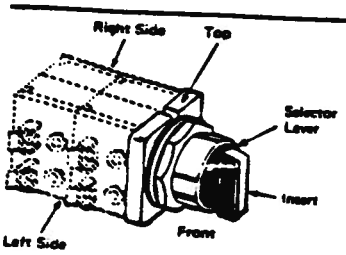
Base	Class	Type	Lamp Volts	Lamp No	Cat No
Miniature Bayonet 	51, 52	Flashing Lamp (Replaces 755 Lamp)	6	267	D13758017
	51, 52	6V Units, Full Voltage Transformer	6	755	D13758024
	51, 52	12V Units, Full Voltage	6	755	D13758024
	52	120, 240V, Full Voltage Push to Test	12	1816	D13758008
	51, 52	24V Units, Full Voltage	24	1829	D13758009
	52	120V, Full Voltage	24	1829	D13758009
	52	Neon	120	120MB	D13758019
				B2A (NE-51H)	D13758010

LED	52	Color	Voltage 6VAC/DC	Voltage 24VAC/DC	Voltage 120VAC/DC
		Red	D13758035	D13758038	D13758041
		Green	D13758036	D13758039	D13758042
		Amber	D13758037	D13758040	D13758043

Discount Schedule E. Discount Schedule D

Pilot Devices
Oil Tight

- Control Units
- Selector Operating Positions
- Contact Sequence



Lever or Key Operator

Selector Position	Level Position X indicates contact closed: Left	Right	Cam Ltr	Contact Block Cat No		Mounting: Left	Right
						Viewed from front	
2	X	O	A	52BAJ	(NC)	L or R	
	O	X		52BAK	(NO)	L or R	
	Illuminated						
	X	O	A	52BAJ	(NC)	L	
	O	X		52BAK	(NO)	L	

Selector Position	Left	Center	Right	Cam Ltr	Contact Block Cat No		Mounting
3	X	O	O	B	52BAK	(NO)	R
	O	O	X		52BAK	(NO)	L
	X	X	O		52BAJ	(NC)	L
	O	X	X		52BAJ	(NC)	R
	X	O	X		(2) *52BAK	(NO)	L or R
	X	O	O	C	52BAJ	(NC)	L or R
	O	O	X		52BAK	(NO)	L or R
	O	X	O	D	52BAJ	(NC)	L or R
	O	O	X		52BAK	(NO)	L or R
	X	O	O	E	52BAK	(NO)	L or R
	O	X	O		52BAJ	(NC)	L or R
	X	O	O	G	52BAJ	(NC)	L
	O	X	O		52BAJ	(NC)	R
	O	O	X		52BAK	(NO)	L or R
	Illuminated						
	X	O	O	C	52BAJ	(NC)	L
	O	O	X		52BAK	(NO)	L
	O	X	O	B	52BAK	(NO)	R
	O	O	X		52BAJ	(NC)	R

*Wired in parallel.

Selector Position	Left	Left Center	Right Center	Right	Cam Ltr	Contact Block Cat No		Mounting
4	X	O	O	O	H	52BAK	(NO)	R
	O	X	O	O		52BAJ	(NC)	L
	O	O	X	O		52BAJ	(NC)	R
	O	O	O	X		52BAK	(NO)	L

Contact and Cam Selection

1. Under Selector Position find the selector operation required (2, 3 or 4 positions).
2. Select the contact operation required for each selector lever Position (X indicates when contacts are closed).
3. The Cam Letter column identifies the cam of the selector operator.
4. Contact block must be assembled in position shown for each circuit application.
5. Cam D, E or G may be ordered at the same price by changing the 6th character of the selector catalog number. Ex: Selector with D cam: 52SA2DAB.
6. C cam on spring return selectors are limited to – contact blocks.
7. Contact scheme for each cam shows possibilities for that cam.
8. To order selectors with different color inserts, take last digit of insert and substitute for last digit of selector.
   Example: White-52SA2AAB Red-52SA2AA2
9. 52BJK(SPDT) block can be used on cams A, B, C, D, E & G, where NO & NC are mounted on the same side.

Push Operators

Selector Position	Level Position X indicates contact closed: Left N	Left D	Right N	Right D	Cam Ltr	Contact Block Cat No		Mounting: Left	Right
								Viewed from front	
2	X	O	O	O	Q	52BAJ	(NC)		R
	X	X	O	O		52BAJ	(NC)	L	
	O	X	O	X		52BAK	(NO)		R
	O	O	O	X		52BAK	(NO)	L	
	X	O	O	O	P	52BAJ	(NC)	L or R	
	O	X	X	X		52BAK	(NO)	L or R	
	X	X	X	O	R	52BAJ	(NC)	L	
	X	O	X	X		52BAJ	(NC)		R
	O	X	O	O		52BAK	(NO)		R
	O	O	O	X		52BAK	(NO)	L	

Selector Position	Left N	Left D	Center N	Center D	Right N	Right D	Cam Ltr	Contact Block Cat No		Mounting
3	X	X	O	O	O	O	S	52BAJ	(NC)	L
	X	O	X	X	O	O		52BAJ	(NC)	R
	O	X	O	O	O	X		52BAK	(NO)	R
	O	O	O	X	O	X		52BAK	(NO)	L

D Button depressed.
N Button not depressed.

Ordering Instructions

- *Other color inserts are available by ordering separate inserts.
- *Contact blocks are ordered separately page E22.
- *Legend Plates page E33.
- *Accessories page E32.

ELECTRICAL COMPONENT

REFERENCE DWG # 425-9001-01/9002

ITEM # 34, 35

MANUFACTURER: IMPULSE, 8274 ROSSON ROAD SAN DIEGO, CA 92111 619-565-7050

DESCRIPTION: CONNECTOR W/ LOCKING SLEEVE

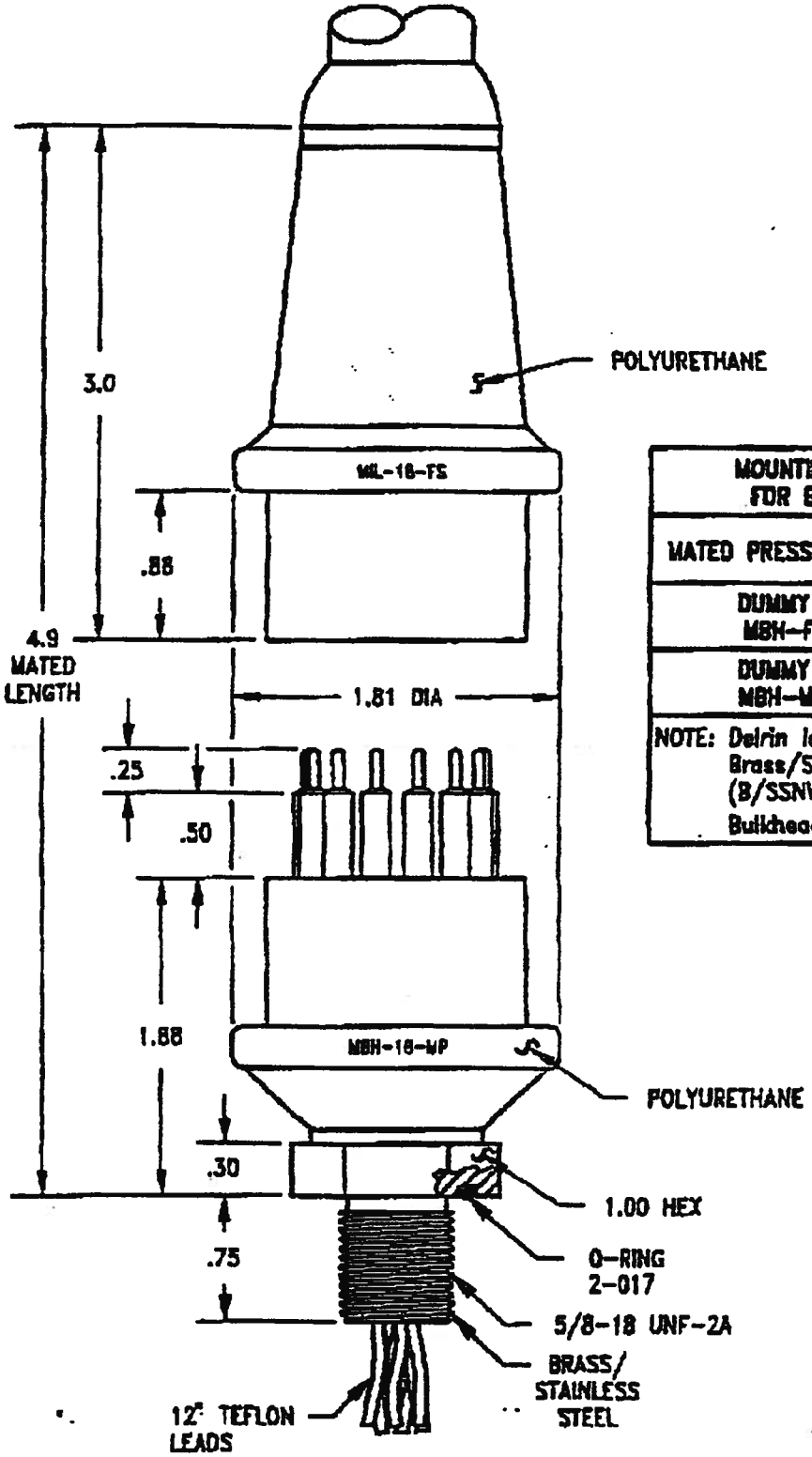
PART NUMBER: BMH-18FS W DLSO-F
MIL-18MP W DLSC-M

DESCRIPTION AND MATERIAL	• Molded neoprene. • Two to twelve contacts, 12 AWG. • Up to 750 VDC. • Up to 20,000 PSI. • Bulkhead connectors open face pressure rated to 5000 PSI.
CABLE	• Connectors in this series are molded on a standard 24" length of 16 AWG SO cable unless otherwise specified. • Bulkhead connectors have 12" teflon leads, Type E per MIL 16878/4 18 AWG.
USES	• Light to heavy duty applications. • Hazardous environments.
GUIDELINES	• All mounting surfaces require a 32 finish. • Lubricate mating surfaces with 3M Silicone Spray or equivalent, DO NOT grease! Connectors must be lubricated on a regular basis. • Lubricate o-rings with Dow Corning #111 Valve Lubricant or equivalent. • Align index pin prior to mating. • Avoid nicks and cuts around contacts as these are the sealing surfaces. • Elastomers can be seriously degraded if exposed to direct sunlight or high ozone levels for extended periods of time. • Connectors should not be allowed to dry out. If this occurs soak in water before use. • Do not over tighten bulkhead nuts. • Do not pull on cable to disconnect. • Avoid sharp bends at cable entry to connector.
ORDERING INFORMATION	• Locking sleeves are optional, specify when ordering. • Bulkhead connectors do not come with nuts and washers. If required, please specify when ordering. • OM connectors do not come with overmolding boots. If required, please specify when ordering.
NOTE	• For Mini Low Profile see Technical Bulletin 65 80

MIL/MBH-18

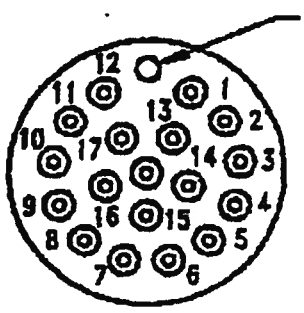
WET
PLUGGABLE

IMPULSE



SCALE 1:1

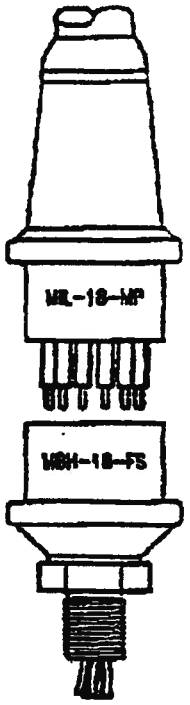
CONTACT CONFIGURATION
(MP FACE VIEW)



18 CONTACT

MOUNTING TORQUE FOR BH-FS/MP	not to exceed 100 in/lbs
MATED PRESSURE RATING (psi)	10,000
DUMMY PLUG FOR MBH-FS, MIL-FS	MDC-18-MP
DUMMY PLUG FOR MBH-MP, MIL-MP	MDC-18-FS

NOTE: Delrin locking sleeve available (DLSD-M or F). Brass/Stainless Steel nut and washer available (B/SSNWB).
Bulkhead receptacle not yet available.



SCALE 1:2

ELECTRICAL COMPONENT

REFERENCE DWG #425-9001-01/9002-0

ITEM # 103, 108-111, 204-206

MANUFACTURER: DIALIGHT, 1913-T ATLANTIC AVENUE MANASQUAN, NJ 08736 908-223-9460

DESCRIPTION: LAMP (AMBER, RED)

PART NUMBER: 125-1310-11-103 w/ 125-1133-403

INCANDESCENT BASE

Enclosed assemblies for heavy-duty industrial applications. Gasketed lens. Lens gives 180° light spread. Uses 6S6 incandescent (bayonet or screw mount) lamp. Supplied without lamp. Unit measures 1¾" x 1⅞".

Type No.	Terminal Screw	Net Each, Lots of 1-99	100-249	250-499
FOR 6S6 SCREW BASE LAMPS				
103-0901-05-103	Side			
103-3101-05-103	Fixed			
FOR 6S6/DC BAYONET LAMPS				
103-3202-05-103	Fixed			
103-3502-05-103	Moveable			

NEON BASE

For use with the 67A (NE-45) candelabra screw base lamp. Lamp has built-in resistor. Overall size approximately 1¾" x 27/32". Comes with internal tooth lockwasher and hex nut. Less lamp. Order holder and lens separately to obtain necessary parts for self-assembly of complete unit.

Type No.	Net Each, Lots of 1-24	25-99	100-499
103-311-05-103			

LENS CAPS FOR HOLDER ABOVE DOME-SHAPED LENSES

Lens No.	Lens Color	Net Each, Lots of 1-99	100-249	250-499
103-1231-403 +	Red			
103-1232-403 +	Green*			
103-1233-403 +	Amber			
103-1211-403•	Red			
103-1212-403•	Green*			
103-1213-403•	Amber			

+ Unfrosted. • Back Frosted. *Not recommended for use with neon lamps.

TORPEDO AND TORPEDO-FACETED LENSES

Lens No.	Lens Color	Net Each, Lots of 1-99	100-249	250-499
103-1331-403 +	Red			
103-1332-403 +	Green*			
103-1333-403 +	Amber			
103-1335-403 +	White			
103-1337-403 +	Clear			
103-0831-403•	Red			
103-0832-403•	Green*			
103-0833-403•	Amber			
103-0835-403•	White			

+ Torpedo faceted unfrosted. •Torpedo unfrosted. *Not recommended for use with neon lamps.

INCANDESCENT BASE

Meets MIL-L-3661. Uses T-3¼ incandescent lamp with miniature bayonet base. Rated 2 to 125 volts. Mounts in 1¼" clearance hole. Less lamp.

Type No.	Term.	Net Each, Lots of 1-99	100-249	250-499
125-0410-11-103	Solder			
125-1310-11-103	Screw			

NEON BASE

Uses 81A (NE-51) neon lamp. Has built-in 56K resistor for use on 105-125VAC or VDC. Mounts in 1¼" clearance hole. Less lamp.

Type No.	Term.	Net Each, Lots of 1-99	100-249	250-499
125-0409-11-143	Solder			

HIGH BRIGHTNESS NEON BASE

Uses 82A (NE-51H) neon lamp. Has built-in 22K resistor for use on 110-125 VAC, bright light. Mounts in 1¼" clearance hole. Less lamp.

Type No.	Term.	Net Each, Lots of 1-99	100-249	250-499
125-0463-11-113	Solder			
125-1363-11-113	Screw			

HIGH BRIGHTNESS NEON BASE

Uses 82A (NE-51H) neon lamp. Has built-in 68K resistor for use on 210-250 VAC or VDC. Mounts in 1¼" clearance hole. Less lamp.

Type No.	Term.	Net Each, Lots of 1-99	100-249	250-499
125-0363-11-163	Screw			

STOVEPIPE LENS CAPS FOR HOLDER ABOVE

Type No.	Lens Color	Net Each, Lots of 1-99	100-249	250-499
125-1131-403*	Red			
125-1133-403*	Green			
125-1133-403*	Amber			
125-1137-403*	Clear			
125-1111-403•	Red			

*Unfrosted. • Back Frosted.

ELECTRICAL COMPONENT

REFERENCE DWG # 425-9001-01/9009-0

ITEM # 104,106

MANUFACTURER: MICROSWITCH, 11 W. SPRING ST. FREEPORT, ILL 61032 800: 537-6945

DESCRIPTION: TOGGLE SWITCH

PART NUMBER: 2TL1-70

SERIES TL PRECISION TOGGLE SWITCHES

Versatile toggle switches feature greater over-surface creepage and clearance distance; double silicon sealing (between cover and case as well as between bushing and toggle lever); integral terminals for stronger wiring connections; step construction for more space between terminals to reduce the possibility of shorting. Single hole bushing mounted. Meet MIL-S-3950 (Immersion) requirements. **Electrical Rating:** (†) Shown in rating table below. **Operating Temperature:** -65° to + 160° F. **Contacts:** Silver cadmium oxide. **Toggle:** Standard; write for information and prices on pull-to-unlock types that prevent accidental toggle movement.

2-POSITION TOGGLE SWITCHES

No. of Poles	Micro Switch No.	Military Number MS-	Rating †	Circuit with Toggle At: One Side	Circuit with Toggle At: Other Side
1	1TL1-2	24823-22	1	Off	On
	1TL1-4	24823-29	1*	Off*	On
	1TL1-6	24823-30	2	On*	Off
	1TL1-3	24823-23	1	On	On
	1TL1-8	24823-28	2	On*	On
2	2TL1-2	24824-22	3	Off	On
	2TL1-4	24824-29	4	Off*	On
	2TL1-6	24824-30	4	On*	Off
	2TL1-3	24824-23	3	On	On
	2TL1-8	24824-28	4	On*	On
4	4TL1-2	24825-22	5	Off	On
	4TL1-4	24825-29	6	Off*	On
	4TL1-6	24825-30	6	On*	Off
	4TL1-3	24825-23	5	On	On
	4TL1-8	24825-28	6	On*	On

3-POSITION TOGGLE

No. of Poles	Micro Switch No.	Military Number MS-	Rating †	Circuit with Toggle At: One Side	Circuit with Toggle At: Center	Circuit with Toggle At: Other Side
1	1TL1-1	24823-21	1	On	Off	On
	1TL1-5	24823-31	2	On*	Off	On
	1TL1-7	24823-27	2	On*	Off	On*
	1TL1-21	24823-34	1	None	Off	On
	1TL1-31	24823-33	1	None	On	On
	1TL1-51	24823-32	2	None	On	On*
	1TL1-61	24823-28	2	On*	Off	None
2	2TL1-1	24824-21	3	On	Off	On
	2TL1-5	24824-31	4	On*	Off	On
	2TL1-7	24824-27	4	On*	Off	On*
	2TL1-21	24824-34	3	None	Off	On
	2TL1-31	24824-33	3	None	On	On
	2TL1-51	24824-32	4	None	On	On*
	2TL1-61	24824-28	4	On*	Off	None
	2TL1-10	27407-4	3	On	On	On
	2TL1-50	27407-5	4	On*	On	On
	2TL1-70	27407-6	4	On*	On	On*
4	4TL1-1	24825-21	5	On	Off	On
	4TL1-5	24824-31	6	On*	Off	On
	4TL1-7	24825-27	6	On*	Off	On*
	4TL1-21	24825-34	5	None	Off	On
	4TL1-31	24825-33	5	None	On	On
	4TL1-51	24825-32	6	None	On	On*
	4TL1-61	24825-28	6	On	Off	None
	4TL1-50	27406-2	6	On*	On	On
	4TL1-12	27406-1	5	On	On	On
	4TL1-72	27406-3	6	On*	On	On*

*Momentary positions; all others are maintained positions. †See rating chart at right. ‡"None" indicates toggle lever is blocked from these positions, leaving only two usable positions. §Only two circuits are completed in this position; all other types complete 1 circuit per pole in "on" position.

ELECTRICAL COMPONENT

REFERENCE DWG #425-9001-01/9009

ITEM # 107207

MANUFACTURER: M/D TOTCO, 1200 CYPRESS CREEK CEDAR PARK, TX 78613 512-331-2219

DESCRIPTION: METER

PART NUMBER: LM 2000 E 533

RON HOHLE

512-331-0411

Specifications:

Temperature: -20°C to 55°C Operating
-30°C to 70°C Storage

Power: 12 or 24 VDC
Isolated, reverse polarity and over voltage protected.

Display: 240 x 128 graphic LCD, selectable and adjustable red or green backlighting

Alarms: 4 setpoints each for Tension, Payout, and Speed
Latching or self-acknowledging
Industry standard relay type/rating
De-energized or failsafe operation

Display Enclosure: 5.7"H x 7.6"W x 4.0"D
NEMA 4. splash proof, front panel mount

LCD MODULE

4022-498-001

$258.70

Part Number 90-01

Draft Revision 3.0

M/D TOTCO™

INSTRUMENTATION

INSTALLATION, CALIBRATION, AND OPERATION

Line Monitor

Manufacturers of Precision Instruments

Printed in U.S.A.

September 11, 1995

Chapter 4, Configuration And Calibration

Chapter 1, Line Monitor Overview

Chapter 2, Installation

Chapter 3, Normal Operation

CHAPTER 1
LINE MONITOR OVERVIEW

The M/D Totco Line Monitor is an instrument that displays the tension, payout, and speed of a cable controlled by a winch. Information is displayed in digital and graphical form on a liquid-crystal display (LCD). Information is presented on various screens which are user-selectable. Some screens include bar graphs, while others include large digital readings. The most typical screen is the Operator's Screen in Figure 1-1.

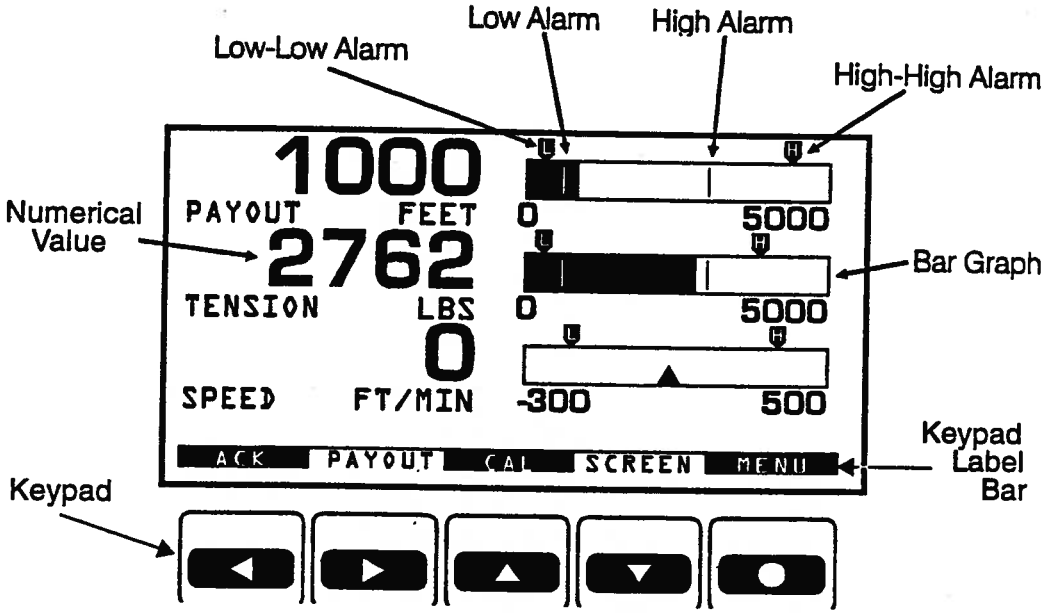


Figure 1-1. Typical Operator's Screen

Values for tension, payout, and speed are shown both as numbers and horizontal bar graphs. The bar graphs also show up to four alarm setpoints for low-low, low, high, and high-high alarms. More information about alarms is in Chapter 3, Normal Operation.

The Line Monitor receives signals from sensors that measure tension, payout, and speed of a cable. The tension sensor must have a 4-20mA output. Payout is measured by a phase-sensitive (quadrature) position sensor. Speed is calculated by the Line Monitor from the payout signal.

The sections that follow describe the Line Monitor's features and functions.

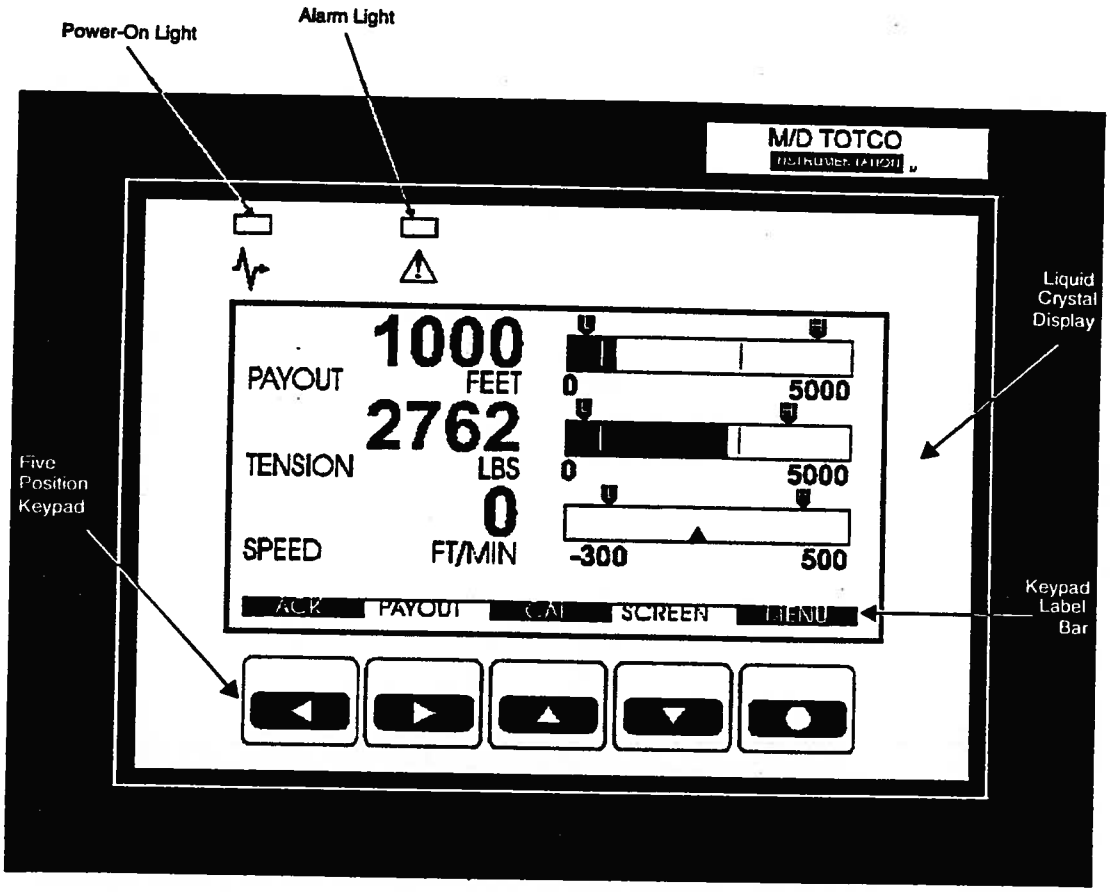


Figure 1-2. Front Panel

The operator can read the LCD in sunlight; it is backlit for use at night. Moreover, the brightness and color of the backlight can be adjusted. Color ranges from green to red in small steps (see Chapter 4, Configuration and Calibration).

The display operates in temperature ranges from -20° C to +70° C (-4° F to +158° F).Contrast can be adjusted via the front panel controls. The unit must be stored within the temperature range from -30° C to +80° C (-22° F to +176° F).

In the lower-left corner of the back panel are three holes allowing access for adjusting the screen contrast, setting the address of the Line Monitor on a network, and reset. Once the Line Monitor is installed, the back panel will rarely need attending.

CHAPTER 2
INSTALLATION

2-1 Overview

Install the Line Monitor by mounting it in a chosen location; then connect the wires for power, sensors, and options. Make all wire connections to the terminal blocks on the back panel of the Line Monitor.

This manual does not address sensor mounting. Install sensors according to manufacturer recommendations.

2-2 Panel Mounting

2-2-1 Cutout

Locate the desired area in the operator's console instrument panel and cut a hole to the dimensions shown in Figure 2-1.

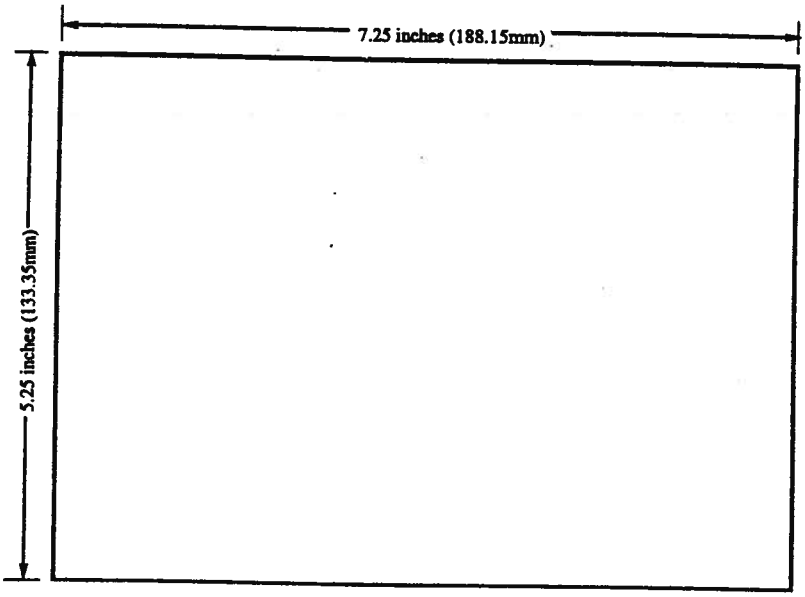


Figure 2-1. Cutout

2-3 Wire Connection

The operator can make wire connections to the Line Monitor using 13 or more terminal blocks on the back panel (Figure 2-2). These terminal blocks are marked TB1 through TB13. There can be an additional four terminal blocks installed on the Line Monitor, each mounted on an option module. Connecting the wires is simply a matter of stripping off 0.25" of insulation, inserting the wire into the proper terminal, and tightening the screw firmly.

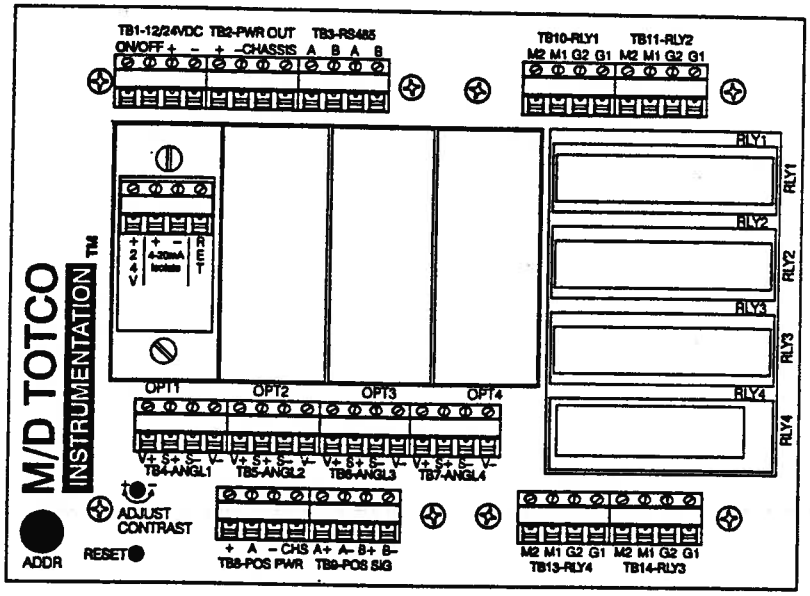


Figure 2-2. Back Panel

2-3-1 TB1-12/24VDC (Power Input)

Connect either a +12 VDC or +24 VDC power source to TB1 as in Figure 2-3. If an external switch is used, it is connected to the ON/OFF terminals as shown in Figure 2-3. Otherwise, it must be jumpered.

The Line Monitor has input protection for both reverse polarity and over-voltage.

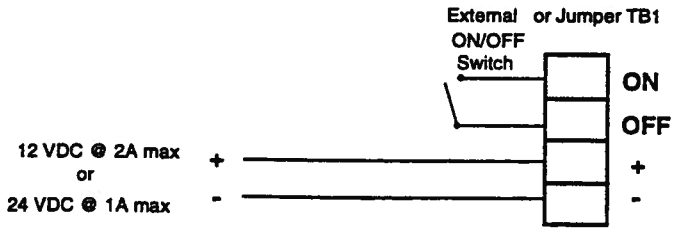


Figure 2-3. Input Power

2-3-4 TB4-ANLG1 (Analog Input #1)

Connect the tension sensor to TB4. Use either two-wire or four-wire 4-20 mA sensor transmitters for connecting the tension sensor to the Line Monitor. Connect two-wire transmitters as in Figure 2-6; connect four-wire transmitters as in Figure 2-7. At a full scale input of 20 mA, the analog input drops less than 2.5 VDC across the internal 100-ohm resistor between S+ to -S. Refer to Chapter 4, Configuration and Calibration, for more information.

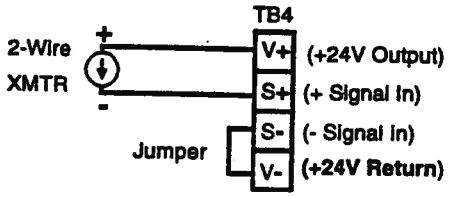


Figure 2-6. Two Wire Analog Input

Figure 2-7. Four Wire Analog Input

2-3-5 TB5-ANLG2 (Not Used)

2-3-6 TB6-ANLG3 (Not Used)

2-3-7 TB7-ANLG4 (Not Used)

2-3-8-3 +12 VDC

To supply +12V to the sensor, install a 1 K ohm resistor, as in Figure 2-10.

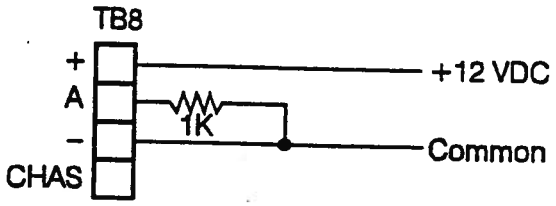


Figure 2-10. +12 VDC Sensor Wiring

2-3-9 TB9-POS SIG (Payout Sensor Signal)

TB9 connects the payout sensor signal wires to the Line Monitor. Use one of four different sensor wiring schemes as specified by the sensor manufacturer; refer to the following four subsections for more information. Also refer to Chapter 4, Configuration and Calibration.

2-3-9-1 TTL (0 to +5 VDC)

To connect a payout sensor that provides 0 to +5 VDC signals, connect the wires as in Figure 2-11. The TTL signals must be referenced to the common terminal, labeled - , of TB8. .

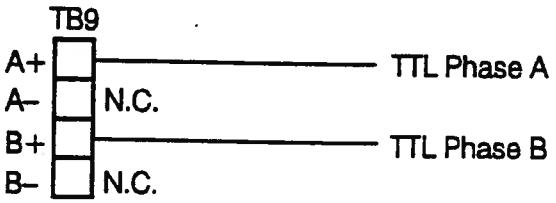


Figure 2-11. TTL Sensor Wiring

2-3-9-4 NAMUR (Proximity)

To connect a payout sensor using NAMUR-type proximity sensing, connect the wires as shown in Figure 2-14.

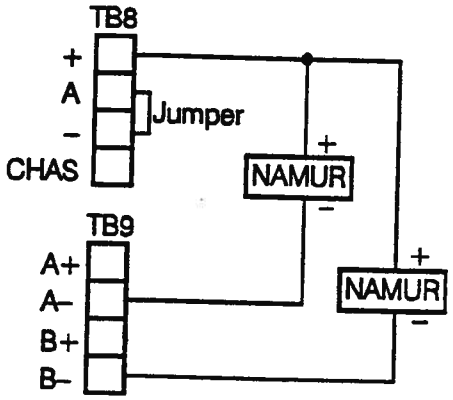


Figure 2-14. NAMUR (Proximity) Sensor Wiring

In Figure 2-15, Form A is normally open. If controlled in "Failsafe" mode, then it will be closed during normal operation, and open during alarm or power off.

Form B is normally closed. If controlled in "Failsafe" mode, then it will be open during normal operation, nad closed during alarm or power off. Refer to Chapter 4, Configuration and Calibration, and Appendix B for more information.

2-3-11 Terminal Blocks for Analog Output and Aux Comm Option Modules 1 to 4

Option modules 1, 2, and 3, if they are provided, supply analog output signals for tension, payout, and speed, respectively. The purpose of these option modules is to supply a scaled voltage signal, which represents tension, payout, or speed, to external monitoring instruments, such as a strip chart recorder or a computerized data logger. Each option module has a terminal block.

For more information, see Chapter 4, Calibration and Configuration, Analog Output Calibration.

2-3-11-1 Analog Output Option Modules

There are two types of analog output option modules:

- Nonisolated
- Ground isolated

Requirements for the nonisolated analog output module are in Figure 2-16. .

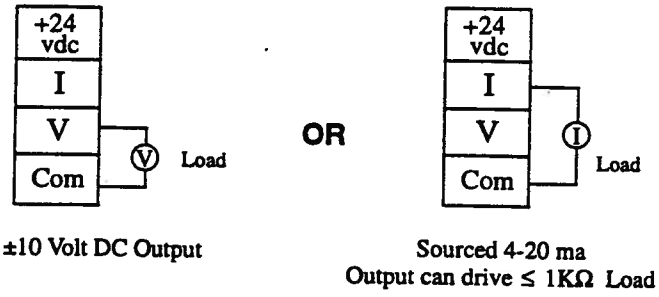


Figure 2-16. Nonisolated Analog Option Module

CHAPTER 3
NORMAL OPERATION

3-1 Power Up

When the Line Monitor is powered on, it performs a short self-test and then shows the Operator's Screen. If the Line Monitor is working properly, the power-on light in Figure 3-1 turns green and there is a short, audible beep. The alarm light in Figure 3-1 turns green if there are no values in alarm; it turns amber or red if there are one or more values in an alarm condition.

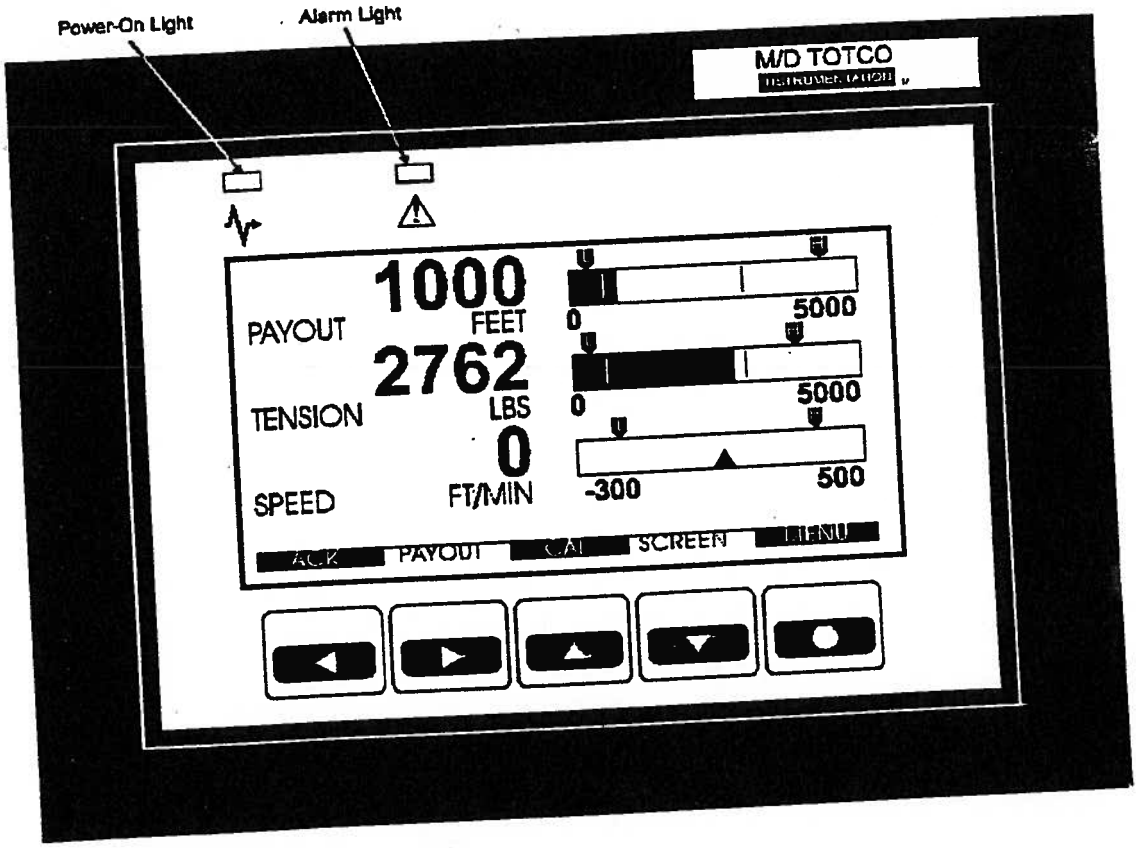


Figure 3-1. Operator's Screen

3-3-1 Keypad Functionality

During setup and calibration, the Line Monitor keys have the characteristics shown in Table 3-2. The exception to this rule is the Operator's Screen (Figure 3-1) and the **MORE** key on the Menu Label Bar (Figure 3-4).:

Table 3-2. Keypad Functionality in Line Monitor Menu Screens

Key Label	Function
S/C	Stop/Cancel, Exit, Abort, Escape
→	Move Cursor
+ -	Change value/selection at cursor location
↵	Enter/Select/Take Action

3-3-2 Label Bars

The label bar is dynamic, meaning it changes to indicate the purpose of each key when the operator navigates among the various screens and menus. There are five different label bars used in the Line Monitor screens and menus:

3-3-2-1 Operator's Screen Label Bar

Figure 3-3 shows the Operator's Screen label bar.

ACK PAYOUT CAL SCREEN MENU

Figure 3-3. Operator's Screen Label Bar

3-3-2-2 Menu Label Bar

The Menu Label Bar (Figure 3-4) is displayed when the operator navigates to any Line Monitor menu.

EXIT NEXT MORE SELECT

Figure 3-4. Menu Label Bar

3-3-2-3 Item Label Bar

The Item Label Bar (Figure 3-5) is displayed when the operator selects a menu item.

Use ▼ ▲ then press MODIFY

EXIT NEXT ▲ ▼ MODIFY

Figure 3-5. Item Label Bar

3-4-1-1 Using the ACK key to Silence a Horn

Silence a horn as follows:

1. Press the **ACK** key on the Operator's Screen.

   The **ACK** key automatically acknowledges and silences the Line Monitor's internal beeper and option relays that control external horns. The Acknowledge Screen appears (Figure 3-8).

2. If the operator wishes only to silence a horn, press **EXIT**.

   The Operator's Screen (Figure 3-1) reappears.

3-4-1-2 Using the Ack Key to Clear All Relays

Clear all optional relays as follows:

1. Press the **ACK** key on the Operator's Screen.

   The **ACK** key automatically acknowledges and silences the Line Monitor's internal beeper and option relays that control external horns. The Acknowledge Screen (Figure 3-8) appears.

2. Press **ENTER**.

   The Line Monitor clears all option relays. The Operator's Screen (Figure 3-1) reappears.

3-4-2 PAYOUT Key

Use the Payout Screen to zero an existing payout value or to enter a preset payout value.

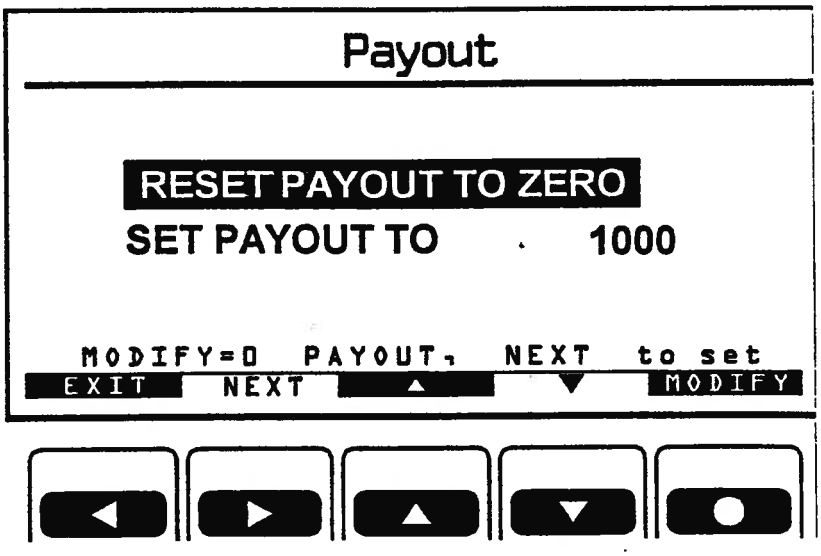


Figure 3-9. Payout Screen

8. Press **EXIT** to return to the Operator's Screen (Figure 3-1).

   The payout value that the operator entered appears as a digital value and is indicated on the bar graph.

3-4-3 CAL Key

Use the Cal Check Screen to engage remote calibration circuits through optional relays in order to verify tension-sensor calibration. Refer to Chapter 4 for more information.

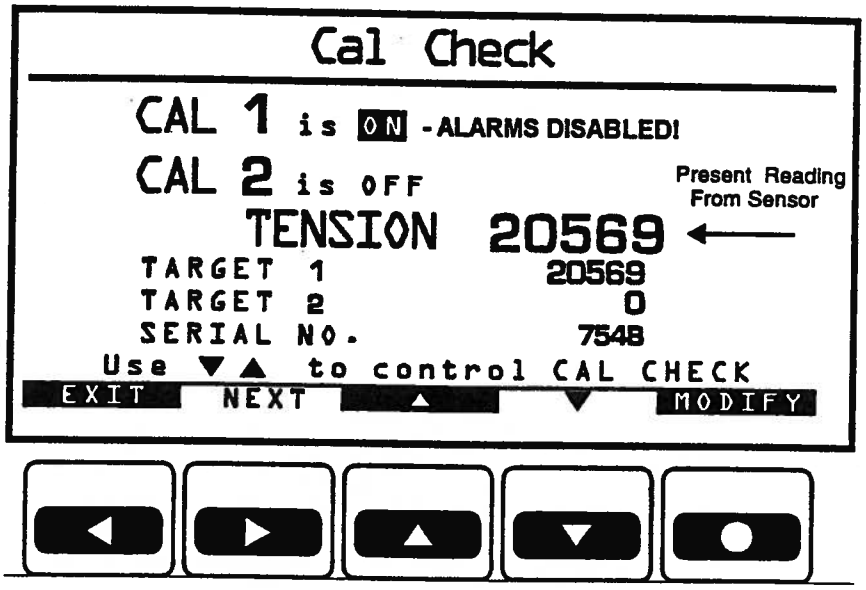


Figure 3-11. Cal Check Screen

3-4-3-1 Verifying Tension-Sensor Calibration

Use the Cal Check Screen to energize remote shunt calibration circuits through optional relays as follows:

1. Press the **CAL** key on the Operator's Screen.

   The Cal Check Screen (Figure 3-11) appears with the **Cal 1** status field highlighted in reverse video.

2. Press ▲ or ▼ to select **ON** or **OFF.**

   Select **ON** to energize remote shunt cal circuits and to **OFF** to deenergize remote shunt cal circuits. **VERIFY TENSION** value displays correct reading.

3. If the operator wishes to change the setting for Cal 2, press **NEXT** to select **Cal 2.**

   The selected data-entry field to the right of **CAL 1** or **CAL 2** highlights in reverse video to indicate it is active.

7. Press **ENTER** to store the value or **CANCEL** to abort the selection.

   Pressing either **ENTER** or **CANCEL** causes the Cal Check Screen to redisplay the Item Label Bar as in Figure 3-11.

8. Use **NEXT** to highlight another **TARGET** field or press **EXIT** to redisplay the Operator's Screen.

3-4-4 SCREEN Key

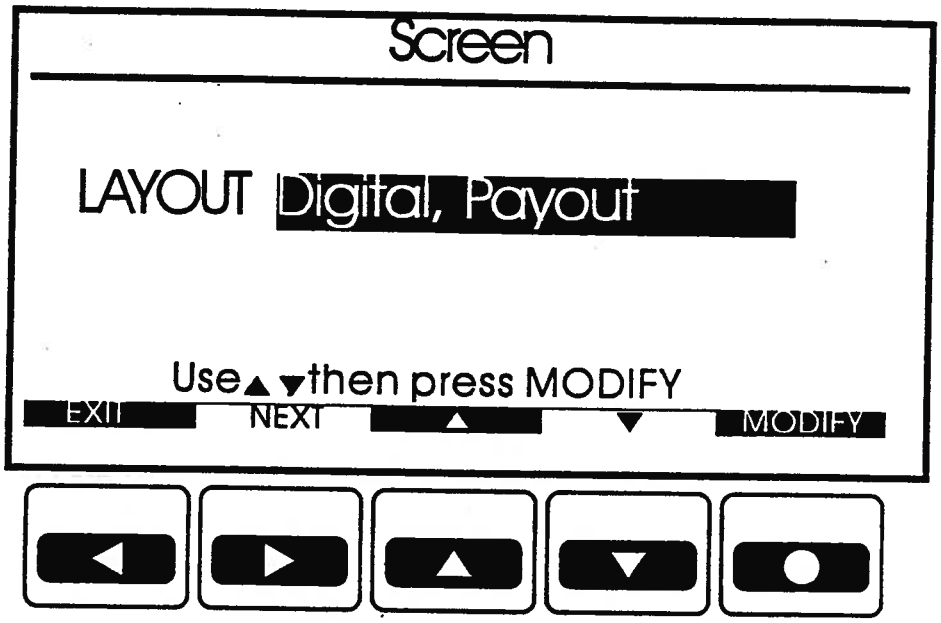


Figure 3-13. Screen Menu

3-4-5 Using the Screen Menu to Select a Screen Layout

Select one of these layout options as follows:

1. Press the **SCREEN** key on the Operator's Screen.

   The Screen Menu (Figure 3-13) appears with the field to the right of **LAYOUT** highlighted in reverse video to indicate it is active.

2. Scroll through the list six screen layout options in the **LAYOUT** field by pressing ▲ or ▼.

   The names of the screen layout options appear in reverse video next to the **LAYOUT** label.

3. When the desired screen layout option appears inside the highlighted field, press **MODIFY.**

   The Operator's Screen screen layout that the operator selected appears on the Line Monitor LCD.

3-4-6-2 Digital Tension Operator's Screen Layout

The Digital Tension layout (Figure 3-15) shows the digital value of the tension in large numbers across the top of the screen and the values of payout and speed in smaller numbers displayed to the lower left and right of the screen. There are no bar graphs used in this screen.

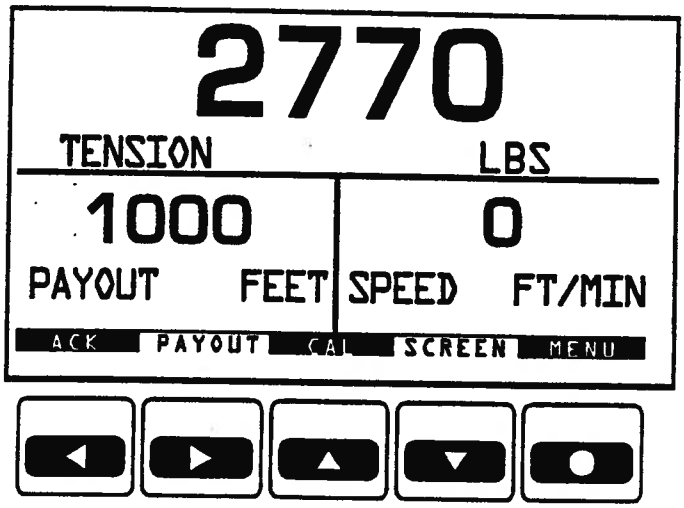


Figure 3-15. Digital Tension Screen

3-4-6-3 Digital Payout Operator's Screen Layout

The Digital Payout layout (Figure 3-16) shows the digital value of the payout in large numbers across the top of the screen and the values of tension and speed in smaller numbers displayed to the lower left and right of the screen. There are no bar graphs used in this screen.

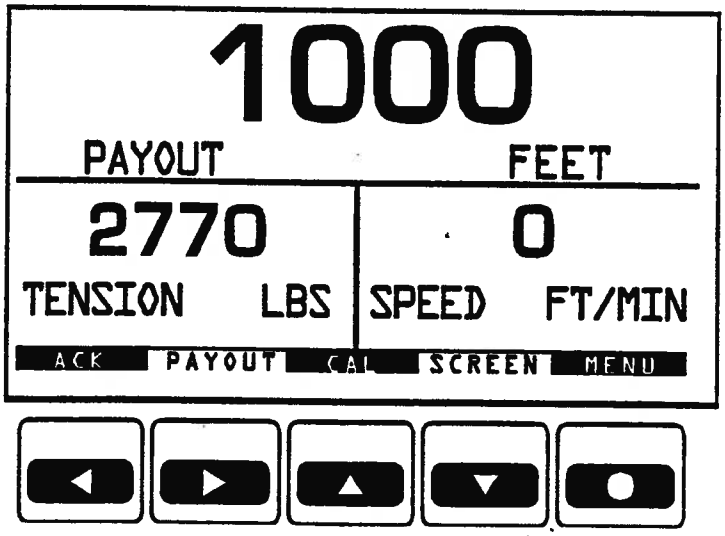


Figure 3-16. Digital Payout Screen

3-4-6-6 Big Bar Graph, Payout Operator's Screen Layout

The Big Bar Graph, Payout layout (Figure 3-19) shows the value of payout in large numbers across the top of the screen and shows a large bar graph of payout, its range, and its four alarm set values across the middle of the screen.

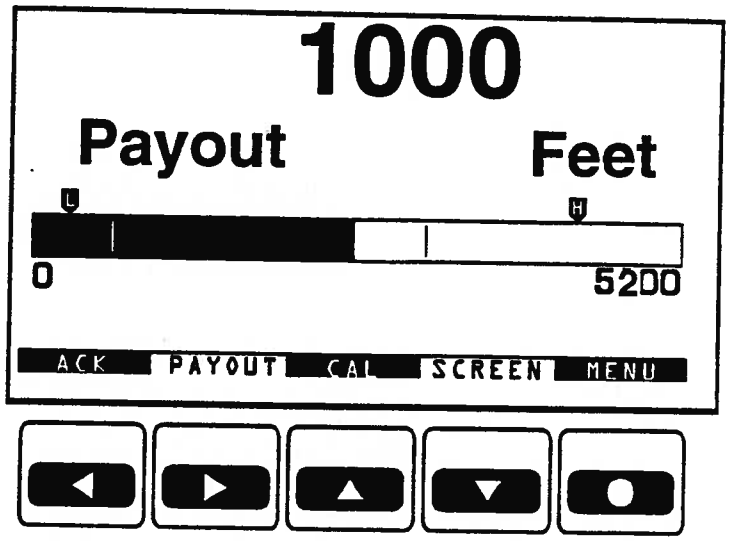


Figure 3-19. Big Bar Graph, Payout Screen

3-4-7 MENU Key

Press the **MENU** key to bring up the Main Menu in Figure 3-20. This menu is the gateway to all configuration and calibration. For a description of the Main Menu, see Chapter 4, Configuration and Calibration.

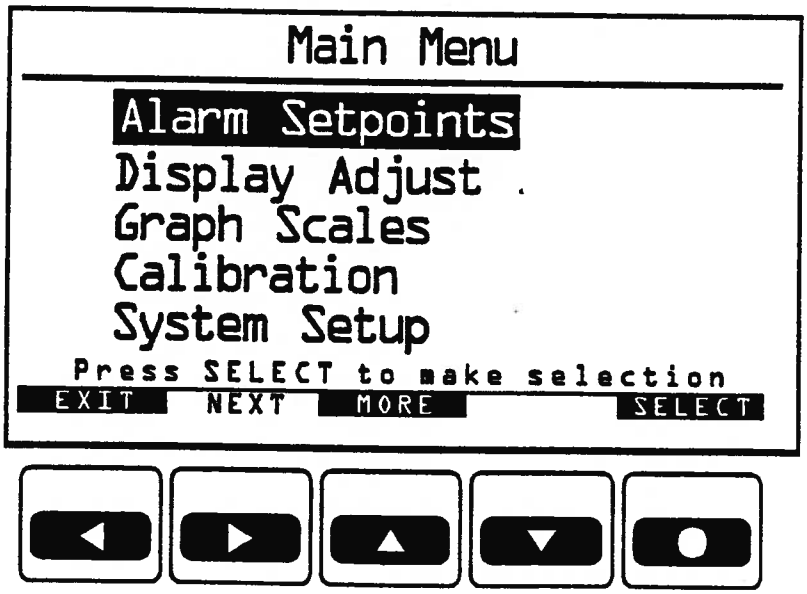


Figure 3-20. Main Menu

CHAPTER 4
CONFIGURATION AND CALIBRATION

This chapter shows how to navigate through and use Line Monitor Configuration and Calibration menus and screens for changing system values and presets. The operator begins from the Operator's Screen, which is the Line Monitor's default screen. For a complete description of the Operator's Screen, refer to Chapter 3, Normal Operation.

Figure 4-1 is a menu tree that shows the navigation routes from the Operator's Screen. The Configuration and Calibration menus and screens are available from the Main Menu.

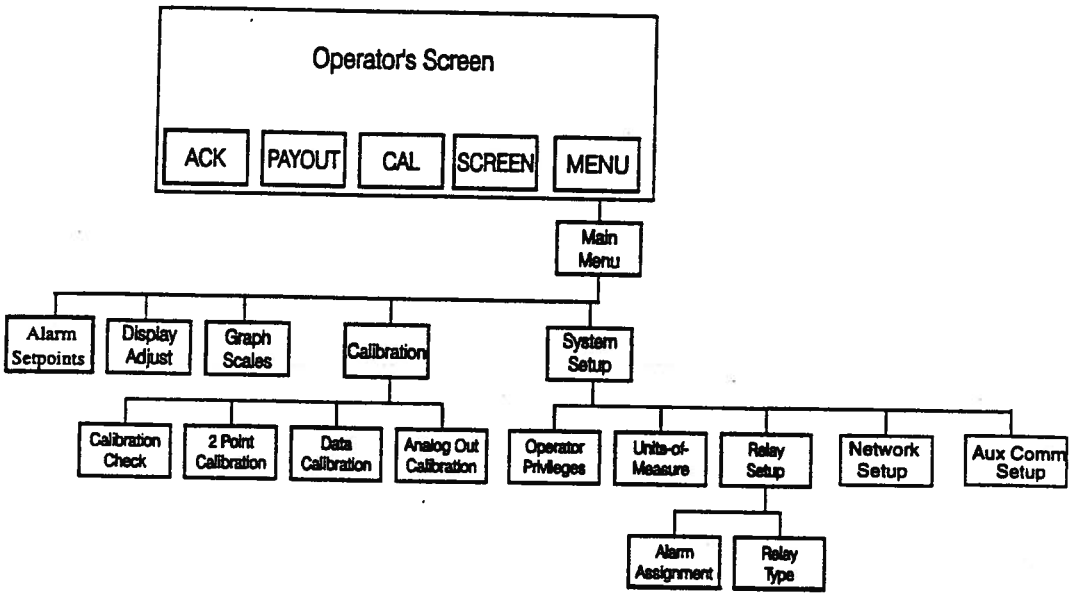


Figure 4-1. Navigation Routes From the Operator's Screen

4-2 Alarm Setpoints Screen

Use the Alarm Setpoints Screen to enter setpoint values for tension, payout, or speed.

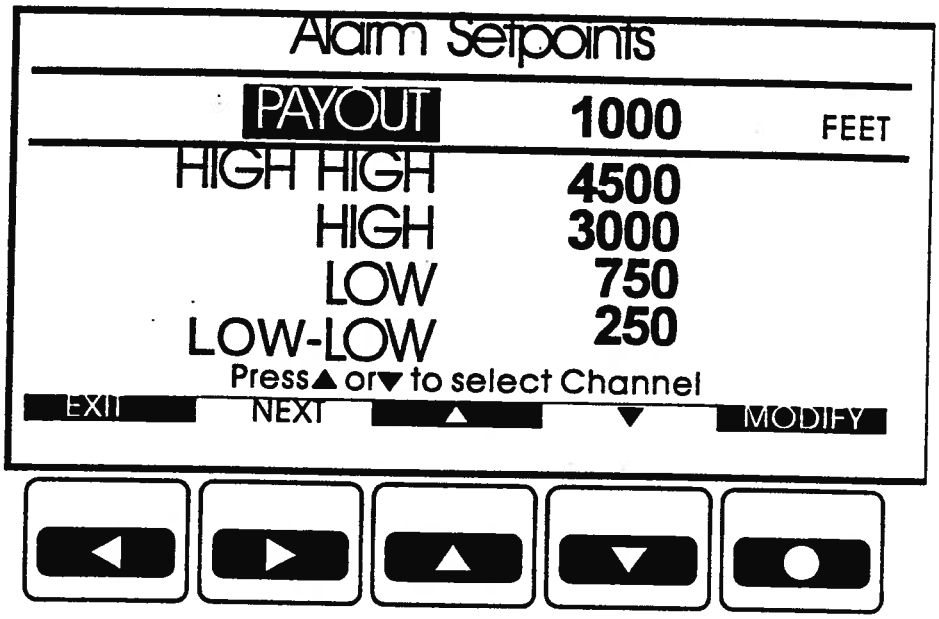


Figure 4-3. Alarm Setpoints Screen

4-2-1 Entering Alarm Setpoints

Enter an alarm setpoint as follows:

1. Choose **Alarm Setpoints** on the Main Menu to display the Alarm Setpoints Screen (Figure 4-3).
2. Use the ▲ or ▼ keys to select tension, payout or speed within the highlighted character field.

   The tension, payout, or speed field appears near the top of the Alarm Setpoints Screen.
3. Use the **NEXT** key to highlight the alarm value to be modified next to **HIGH-HIGH, HIGH, LOW,** or **LOW-LOW.**

   The character field to the right of the alarm parameter that the operator selects highlights in reverse video to indicate it is active.
4. Press the **MODIFY** key to change the selected value.

   The Data-Entry Label Bar appears (Figure 4-4), and the digit cursor is displayed.

Figure 4-4. Data-Entry Label Bar on the Alarm Setpoints Screen

4-3-1 Adjusting the Backlight Brightness

Adjust the Line Monitor LCD backlight brightness as follows:

1. Choose **Display Adjust** on the Main Menu to bring up the Display Adjust Screen (Figure 4-5).

   The Display Adjust Screen appears; the number field to the right of the Backlight Brightness item is highlighted in reverse video to indicate it is active.

2. Press **MODIFY** to change the Backlight Brightness value.

   The Display Adjust Screen goes into configuration mode, the Data-Entry Label Bar appears (Figure 4-6), and the digit cursor is displayed.

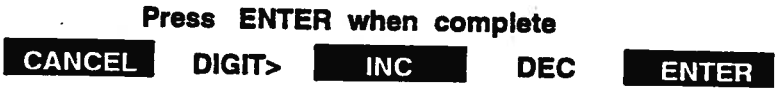


Figure 4-6. Data-Entry Label Bar on the Display Adjust Screen

3. Use the **DIGIT>** key to move the digit cursor and highlight the digit to be modified.
4. Use the **INC** or **DEC** keys to increment or decrement the selected digit.
5. Press the **ENTER** key to accept the desired value.

   The number field containing the modified digit displays the new value in reverse video. The Backlight Brightness now conforms to the new setting. The Item Label Bar is redisplayed (Figure 4-5).

6. Press the **EXIT** key.

   The Main Menu appears (Figure 4-2).

4-3-2 Adjusting the Backlight Color

Adjust the Line Monitor LCD backlight color as follows:

1. Choose **Display Adjust** on the Main Menu to bring up the Display Adjust Screen (Figure 4-5).

   The Display Adjust Screen appears.

2. Use the **NEXT** key to select **Backlight Color.**

   The number field to the right of the Backlight Color item is highlighted in reverse video to indicate it is active.

4-4 Graph Scales Screen

Use this screen to configure the bar-graph display on the Operator's Screen for tension, payout, or speed. The left scale value is the left side limit in the bar-graph range, and the right scale value is the right side limit in the bar-graph range.

Adjusting Graph Scales affects bar-graph displays only. It does not affect alarm operation or digital readouts. .

> **NOTE**
>
> Exchange the **LEFT SCALE** and **RIGHT SCALE** values to display graph-scale changes in the opposite direction.

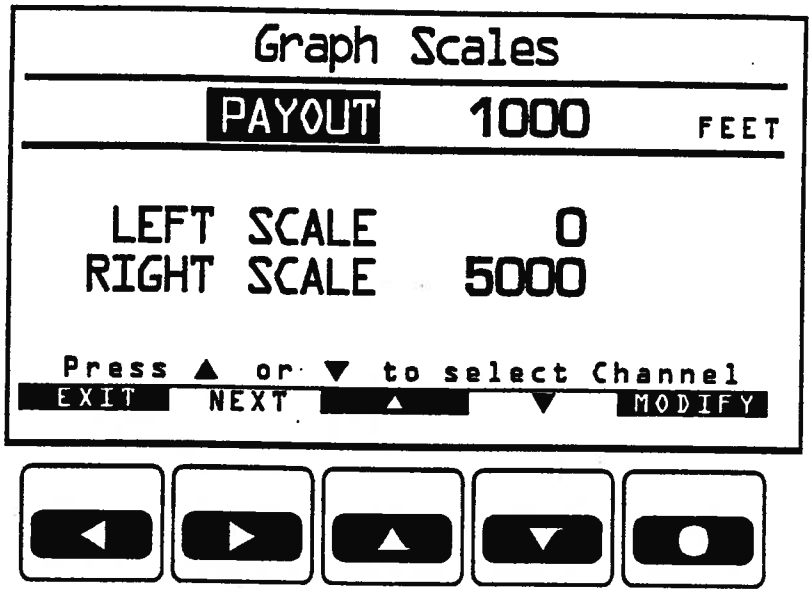


Figure 4-8. Graph Scales Screen

4-4-1 Entering Graph Scale Values

The procedure for entering Graph Scale Values is as follows:

1. Choose **Graph Scales** on the Main Menu to bring up the Graph Scales Screen (Figure 4-8).
2. Use the ▲ or ▼ keys to select tension, payout or speed.
   The tension, payout, or speed label appears near the top of the Graph Scales Screen.
3. Use the **NEXT** key to highlight the **LEFT SCALE** or **RIGHT SCALE** value.
4. Press the **MODIFY** key.

4-5 Calibration Submenu

Use the Calibration submenu to check sensor calibration, calibrate sensors, and to calibrate analog-output modules. Highlight one of the following options using the **NEXT** button:

- Cal check
- Two-point calibration
- Data calibration
- Analog-output calibration

Each of the above options is explained in the subsections that follow.

Choose **Calibration** on the Main Menu to bring up the Calibration Submenu (Figure 4-10).

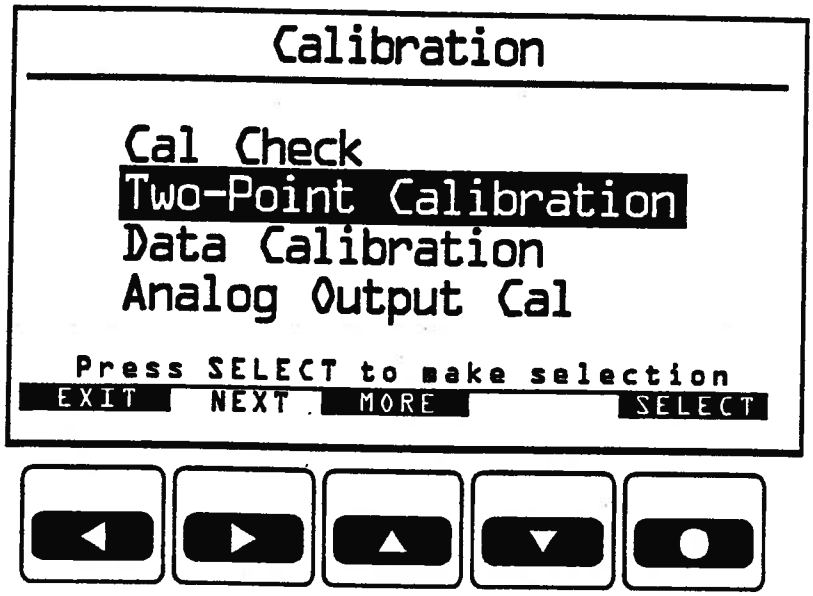


Figure 4-10. Calibration Submenu

4-6-2 Enterning Numbers Into the Scratch Pad

Use the **TARGET 1, TARGET 2** and **Serial No.** fields in the Cal Check Screen to store tension calibration constants entered into the unit from Calibration Data Sheets or by CAL circuit demonstration. These values are visual references to compare with the CAL circuit **TENSION** value..

> **NOTE**
>
> The **Target1, Target2** and **Serial Number** fields are for user convenience only. The instrument has no "intelligence" regarding these numbers.

Use the Cal Check Screen to verify tension-sensor calibration as follows:

1. Press the **CAL** key on the Operator's Screen.

   The Cal Check Screen (Figure 3-11) appears with the **Cal 1** character field highlighted in reverse video.

2. Use the **NEXT** key to highlight the desired character field to the right of **TARGET 1** or **TARGET 2**. or **S/N**.

   The character field that the operator selects highlights in reverse video to indicate it is active.

3. Press **MODIFY.**

   The Cal Check Screen goes into Configuration Mode, brings up the Configuration Label Bar (Figure 3-12), and displays the digit cursor.

Press ENTER when complete

CANCEL **DIGIT>** **INC** **DEC** **ENTER**

Figure 3-12. Data-Entry Label Bar on the Cal Check Screen

4. Use the **DIGIT>** key to move the cursor to the digit space (one of seven) to be modified.

   The digit that the operator selects highlights in reverse video.

5. Use the **INC** and **DEC** keys to increase or decrease the highlighted digit.

6. Repeat Steps 4 and 5 as needed.

7. Press **ENTER** to store the value or **CANCEL** to abort the selection.

   Pressing either **ENTER** or **CANCEL** causes the Cal Check Screen to redisplay the Item Label Bar as in Figure 3-11.

8. Use **NEXT** to highlight another **TARGET** field or press **EXIT** to redisplay the Operator's Screen.

The Data-Entry Label Bar (Figure 4-14) appears, and the digit cursor is displayed.

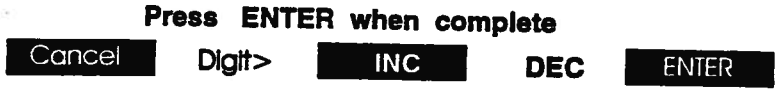


Figure 4-14. Data-entry Label Bar on the Two-Point Calibration Screen

8. Use the **DIGIT>** key to move the digit cursor to the digit space (one of seven) to be modified.
9. Use the **INC** and **DEC** keys to increment or decrement the highlighted digit.
10. Press **ENTER** to store the value or **CANCEL** to abort the selection.
    At this point, load on sensor is read (captured) and assigned to display the value entered.
11. The Item Label Bar reappears.
12. Use the **NEXT** key to highlight the **High Cal Point** character field
13. Apply a maximum load to the tension sensor.
14. Press **MODIFY.**
15. The Data-Entry Label Bar (Figure 4-14) appears, and the digit cursor is displayed.
16. Use the **DIGIT>** key to move the digit cursor to the digit space (one of seven) to be modified.
17. Use the **INC** and **DEC** keys to increment or decrement the highlighted digit.
18. Press **ENTER** to store the value or **CANCEL** to abort the selection.
19. The Item Label Bar reappears.
20. Press **EXIT** to redisplay the Operator's Screen.

> **NOTE**
>
> It is very important to record the numbers that the Line Monitor shows for the **offset** and **slope** for each sensor after they are calibrated. Keep the recorded numbers in a secure place. They can be used to restore calibration if Line Monitor data becomes corrupt.

4-7-2 Shunt Calibration (Remote Calibration)

Use the Two-Point Calibration Screen to do Shunt Calibration as follows:

1. Navigate to the Two-Point Calibration screen:
   Main Menu > Calibration > Two-Point Calibration

3. Use the **NEXT** key to highlight **Signal From.**
4. Use the ▲ or ▼ keys to highlight **Cal 2.**
5. Use the **NEXT** key to highlight the **Low Cal Point** character field.
6. Press **MODIFY.**

   The Data-entry Label Bar appears (Figure 4-16), and the cursor changes to the digit cursor.

Figure 4-16. Data-entry Label Bar on the Two-Point Calibration Screen

7. To key in the appropriate tension value of the low tension standard for the Low Cal Point on the screen, use the **DIGIT>** key to move the digit cursor to the digit space (one of seven) to be modified.
8. Use the **INC** and **DEC** keys to increment or decrement the highlighted digit.
9. Press **ENTER** to store the value and capture the Low Cal Point; press **CANCEL** to abort the selection.

   The Item Label Bar reappears.
10. Use the **NEXT** key to highlight the **Signal From** character field.
11. Use the ▲ or ▼ keys to select **Cal 1.**
12. Use the **NEXT** key to highlight the **High Cal Point** character field.
13. Press **MODIFY.**

    The Two-Point Calibration Screen will show the Data-Entry Label Bar (Figure 4-15), and the digit cursor is displayed.
14. To key in the maximum tension value of the high load standard for the High Cal Point on the screen.
15. Use the **DIGIT>** key to move the digit cursor to the digit space (one of seven) to be modified, use the **INC** and **DEC** keys to increment or decrement the highlighted digit.
16. Press **ENTER** to store the value and capture the High Cal Point; press **CANCEL** to abort the selection.

    The Item Label Bar reappears.
17. After the calibration is completed, be sure to enter **Sensor** in the **Signal From** character field.
18. Press **EXIT** to redisplay the Operator's Screen.

6. Once the desired number is entered, press **ENTER** to store the value or **CANCEL** to return the original value.
7. Press **Next** to select **Slope.**
8. Press **Modify** if changes are required.

   The Data-Entry Label Bar appears (Figure 4-19), and the cursor changes to the digit cursor.

Figure 4-19. Data-entry Label Bar on the Data Calibration Screen

9. To enter the "slope" calibration factor, use **DIGIT>** to move the digit cursor and highlight the desired whole number digit position.

   Use the **INC** and **DEC** keys to increment or decrement the number in the highlighted digit space.

10. Once the desired number is entered, press **ENTER** to store the value or **CANCEL** to return the original value.
11. Repeat Steps 2 - 10 for tension, payout, and speed, until all settings are correct.
12. Press **Exit** to return to the Cal Submenu.

4. Press **Modify.**

   The Data-entry Label Bar appears (Figure 4-21), and the digit cursor is displayed.

Figure 4-21. Data-entry Label Bar on the Analog Output Cal Screen

5. Use **DIGIT>** to move the digit cursor and highlight the desired whole number digit position.
6. Use the **INC** and **DEC** keys to increment or decrement the number in the highlighted digit space.
7. Once the desired number is entered, press **ENTER** to store the value or **Cancel** to return the original value.
8. Use the **Next** key to highlight the top value in the right column of the screen.

   This number represents the percentage of the minimum analog output.
9. Press **Modify.**

   The Data-entry Label Bar appears (Figure 4-21), and the digit cursor is displayed.
10. Use **DIGIT>** to move the digit cursor and highlight the desired whole number digit position.
11. Use the **INC** and **DEC** keys to increment or decrement the number in the highlighted digit space.
12. Once the desired number is entered, press **ENTER** to store the value or **Cancel** to return the original value.
13. Use the **Next** key to highlight the bottom value in the left column of the screen.

    This number represents the maximum graph scales value of tension, payout, or speed thata will be displayed on the Operator's Screen.
14. Press **Modify.**

    The Data-entry Label Bar appears (Figure 4-21), and the digit cursor is displayed.
15. Use **DIGIT>** to move the digit cursor and highlight the desired whole number digit position.
16. Use the **INC** and **DEC** keys to increment or decrement the number in the highlighted digit space. Make number selection based on the external display device or a digital mulitmeter.
17. Once the desired number is entered, press **ENTER** to store the value or **Cancel** to return the original value.
18. Use the **Next** key to highlight the bottom value in the right column of the screen.

    This number represents the percentage of maximum analog output.

4-10 System Setup Menu

Use the System Setup Submenu (Figure 4-22) to display screens for setting:

- Operator Privileges
- Units Of Measure
- Relay Setup Options
- Network Setup
- Aux. Comm. Setup

Procedures for using each System Setup screen are in the sections that follow.

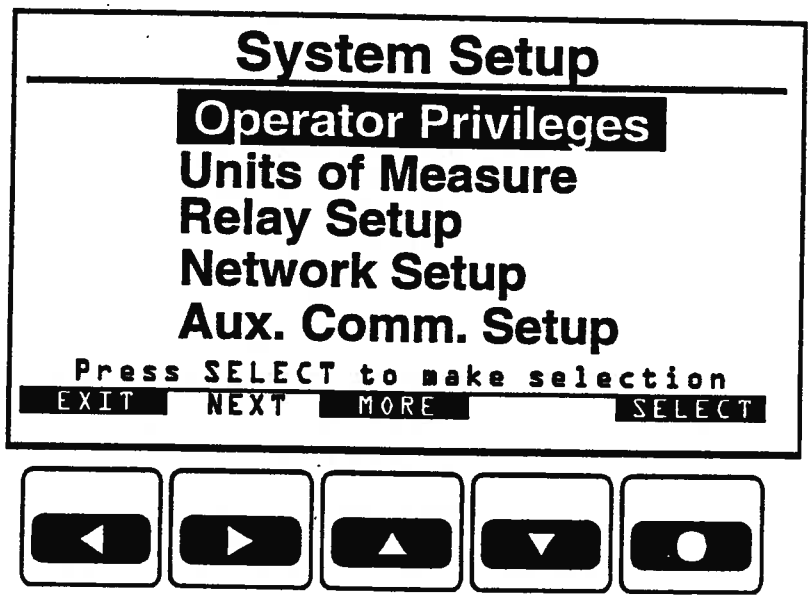


Figure 4-22. System Setup Submenu

The highlighted privilege, **Y** or **N**, changes to its opposite.

4. Repeat the above procedure for each privilege to be changed.
5. Once the desired privileges have been entered, press **EXIT**.

> **NOTE**
>
> If the operator chooses **N** for **System Setup**, he will not be able to enter the Operator Privileges Screen without a password.

4-10-2 Units of Measure Screen

Use the Units Of Measure Screen to choose the units of measure and precision for displayed numbers of tension, payout, and speed.

> **NOTE**
>
> Units of measure are displayed text only. The calibration is NOT adjusted automatically to follow the units. If units are changed, recalibration is required.

The precision can be set as a positive or negative number up to seven. Positive numbers define the decimal precision. For example, a precision of 0 means no decimal place is shown (the displayed number looks like xxx with no decimal point); a precision of 1 means xxx.x is shown; 2 means xxx.xx is shown; 3 means xxx.xxx is shown; and so forth. Negative numbers define how many digits are rounded off. For example, 0 means that all digits of the measured number are displayed (like xxxxx); -1 means the last digit is rounded to the nearest ten (like xxxx0), -2 means that the last two digits are rounded to the nearest hundred (like xxx00); -3 means that the last three digits are rounded to the nearest thousand (like xx000); and so forth.

The procedure for using the Units of Measure Screen is as follows:

1. Navigate to the Units of Measure Submenu:

   Main Menu > System Setup > Units of Measure

   The Units of Measure Submenu (Figure 4-24) appears.

11. Repeat Steps 2 through 8 until Tension, Payout, and Speed are configured.
12. Press **Exit.**

The System Setup Submenu reappears (Figure 4-22).

> **NOTE**
>
> If Tension or Payout units were changed, then recalibration is required.

4-10-3 Relay Setup Submenu

Use the Relay Setup Submenu to choose the alarm assignments and to tell the Line Monitor what each relay does. Refer to Appendix B, Alarms and Relays, for more information.

The procedure for using the Relay Setup Submenu is as follows:

1. Navigate to the Relay Setup Submenu:

   Main Menu > System Setup > Relay Setup

   The Relay Setup Submenu (Figure 4-26) appears.

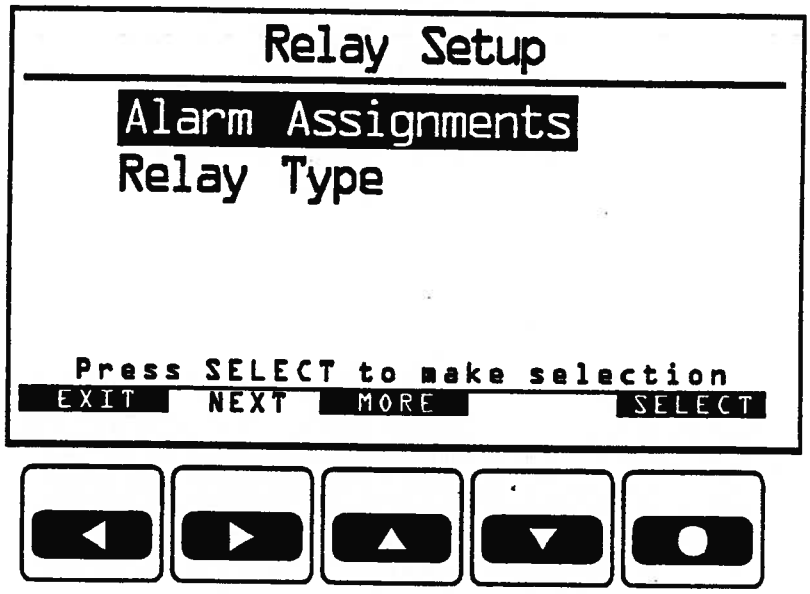


Figure 4-26. Relay Setup Submenu

2. Use the ▲ or ▼ keys to select **Alarm Assignment** or **Relay Type.**

   The operator's selection highlights with a dark field to indicate it is active.

3. Press **Select.**

   The submenu corresponding with the operator's selection, **Alarm Assignments** or **Relay Type**, appears.

7. Repeat Steps 2 through 6 until all assignments are correct.
8. Press **EXIT**.

4-10-3-2 Relay Type Submenu

The Line Monitor controls relays in one of six different ways, depending on the function (purpose) of the relay. The purpose of a relay is referred to as a relay type. Relay type refers to the way the instrument controls the relay; relay type does NOT refer to the type of physical relay installed.

The term "latched" means that once a signal exceeds an alarm setpoint, the relay will remain in the alarm state until it is acknowledged via the front panel. It has to be acknowledged even if the signal has returned to the normal range.

The term "unlatched" means that the relay will reflect the present signal value; it does not need to be acknowledged.

Use the Relay Type Submenu to tell the Line Monitor how to control each relay. The relay position (Relays 1 to 4) are in the left column of the screen and the relay types are in the right column.

The procedure for using the Relay Type Submenu is as follows:

1. Choose **Relay Type** from the Relay Setup Submenu.
   The Relay Type Submenu (Figure 4-28) appears.

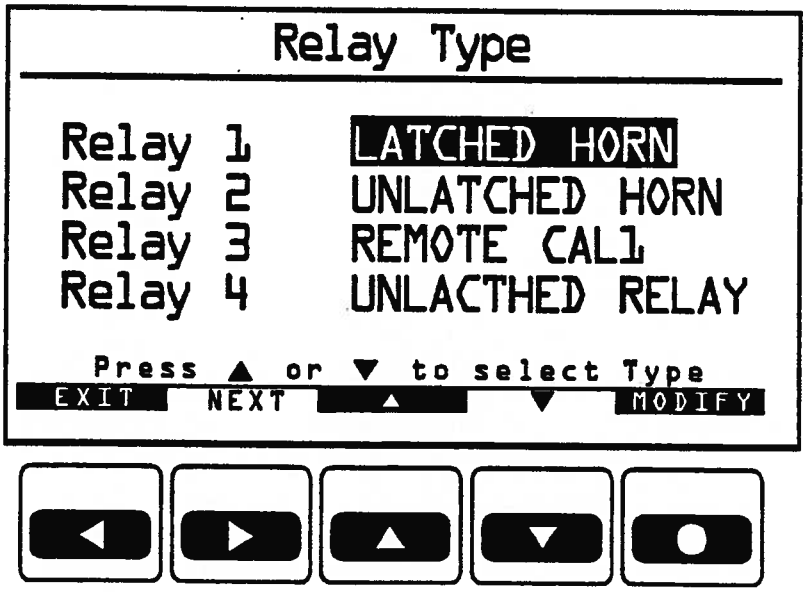


Figure 4-28. Relay Type Submenu

4-10-4 Network Setup Screen

Use the Network Setup Screen to designate the line monitor as a sensor input unit or a remote display unit.

For line monitors designated as Sensor Input Units, it is necessary to set the rotary switch on the back of the unit until the first unit reads "1" on the **Rotary Switch** Field in the Network Setup screen. Then use the rotary switch to set each succeeding Line Monitor in numerical order from the first: 1, 2, 3, etc.

For Line Monitors designated as Remote Displays, it is necessary to select the Remote Display number in the first field of the Network Setup Screen. Then use the rotary switch to match the winch number most commonly displayed. In the Operator's Screen, select the winch number to be displayed now. Use the same procedure to make the remote display number in numerical order.

4-10-4-1 Configuring the Line Monitor as a Sensor Input Unit

The procedure for configuring the Line Monitor as a Sensor Input Unit is as follows:

1. Navigate to the Network Setup Screen:
   Main Menu > System Setup > Network Setup
   The Network Setup Screen (Figure 4-29) appears.

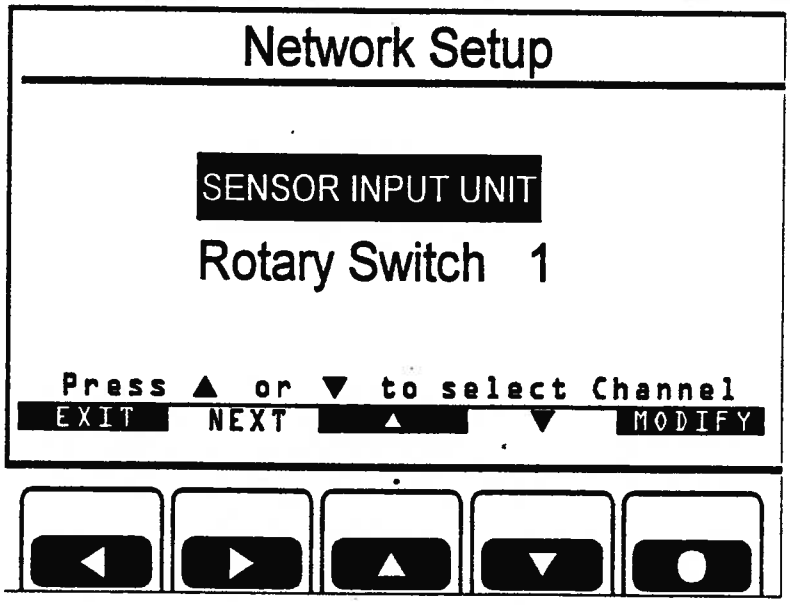


Figure 4-29. Network Setup Screen

2. Use the ▲ or ▼ keys until the top field reads **SENSOR INPUT UNIT.**
   The top field reads **Sensor Input Unit** highlighted in reverse video.
3. Adjust the rotary switch on the back of the unit to the appropriate setting.

4-10-5 Aux. Comm. Setup Screen

Use the Aux. Comm. Setup Screen to configure serial communications to a customer computer or other device via RS-232 or RS-485 connectors. Possible configurations via the Aux. Comm. Setup Screen are:

- Changing the data interval
- Changing data-transmission baud rate
- Enabling or disabling parity
- Choosing even or odd parity

The Line Monitor recognizes these commands from an external device:

- SS (Single Scan)
- CS (Continuous Scan)
- CD (Configuration dump)

For complete information on the communications protocol, refer to Appendix XXX.

Use the Aux. Comm. Setup Screen as follows:

1. Navigate to the Aux. Comm. Setup Screen:

   Main Menu > System Setup > Aux. Comm. Setup

   The Aux. Comm. Setup Screen (Figure 4-30) appears.

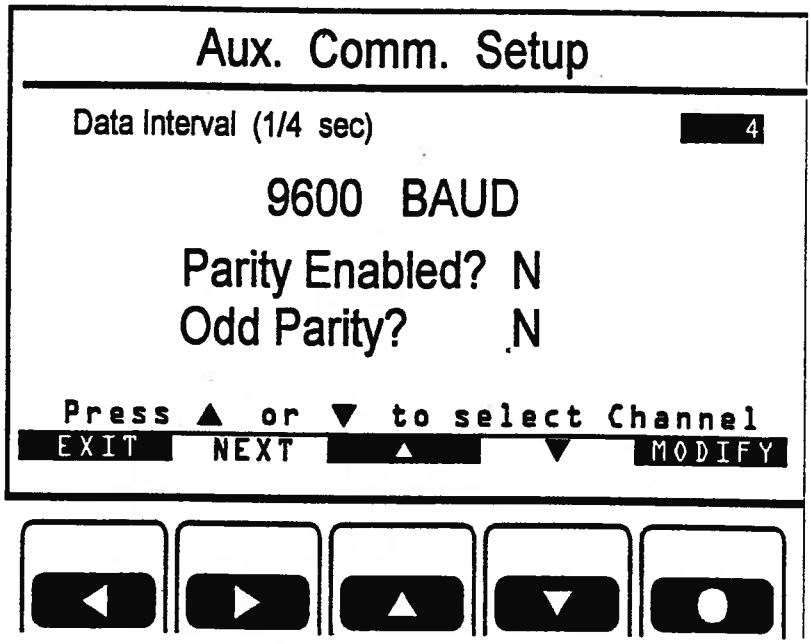


Figure 4-30. Aux. Comm. Setup Screen

ELECTRICAL COMPONENT

REFERENCE DWG # 424-9001-01/9009-01

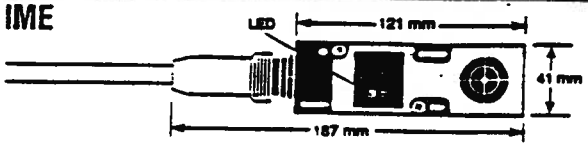
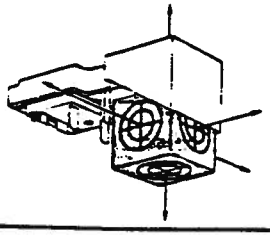
ITEM # 301, 302, 304, 305

MANUFACTURER: EFECTOR, 805 SPRINGDALE DRIVE WHITELAND BUSINESS PARK EXTON, PA 19341 800-441-8246

DESCRIPTION: PROXIMITY SENSOR

PART NUMBER: IME3015FNKG

2-wire AC, 2-wire AC/DC, 3-wire DC inductive switches for use with Brad Harrison Mini-style connectors

	NOMINAL DETECTION RANGE AND CORRECTION FACTORS	CONSTRUCTION/ ENVIRONMENTAL
IME  Five-way sensing The Model IME features a sensing element which can be positioned to sense in any of five directions. 	15 mm flush mountable  SS 0.7, Br 0.4, Al 0.4 20 mm nonflush mountable  SS 0.7, Br 0.4, Al 0.4	Polycarbonate. Operating range of -13 to 176°F (-25 to 80°C). NEMA 3, 4, 12, 13. IP 65. FM Div. 2 (when wired per NEC). On AC switches CSA approved or approval pending (CSA approval not required at less than 30 V). Splashproof. Oil & dust tight.

TYPE	OUTPUT	PART NUMBER		CURRENT: SUPPLY	MAX. INRUSH	MAX. LOAD	MIN. LOAD	LEAKAGE	SUPPLY VOLTAGE	MAX. SWITCHING RATE	VOLTAGE DROP@ MAX. LOAD
3-wire DC	~~Pos. sw., N.O./N.C.~~ Neg. sw., N.O./N.C.	~~IME3015FPKG/LS400LPS~~ IME3015FNKG/LS400LNS		~~5 mA~~ 5 mA	~~200 mA~~ 100 mA	~~200 mA*~~ 100 mA*	~~2~~ 0	~~negligible~~ negligible	~~10-55 VDC~~ 10-30 VDC	~~250 Hz~~ 15 Hz	~~1.5 V~~ 1.0 V

ELECTRICAL

2-Wire AC/DC

The 2-wire AC/DC model features very low leakage and voltage drop, allowing the unit to be used directly into PC's without interfacing concerns in most cases.

3-Wire DC

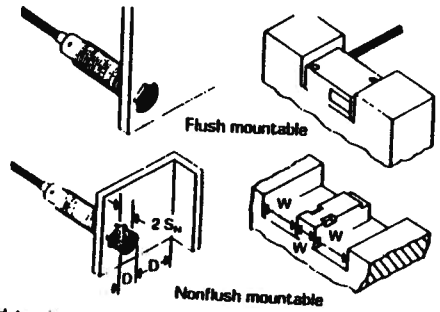
Two models are available. The PNP (sourcing, positive switching) switches the positive supply line referenced to ground (minus a small, internal voltage drop) through the output wire. The NPN (sinking, negative switching) pulls down the output wire to ground, minus a small voltage drop and is referenced to positive supply.

Plug-in Model

The plug-in model is factory prewired as N.O. Programming for N.C. is possible by modifying the wire link programming per above.

Installation

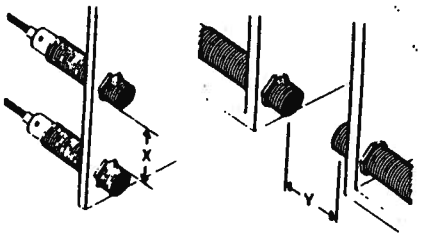
Flush-mountable models can be mounted so they are completely surrounded by metal, except for the sensing face. Nonflush-mountable models must have an open zone around them.



S_n = Nominal detection range

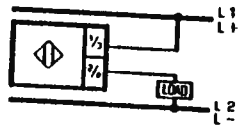
Installation (continued)

Inductive units can interfere with each other if they are mounted too close. The X distance must be greater than twice the diameter for nonshielded units and one times the diameter for shielded units. Y must be greater than eight times the nominal detection range.



Wiring

2-Wire **AC/DC**



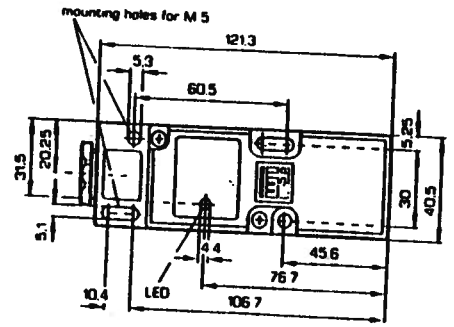
programming:
wire link closed:
wire link open:

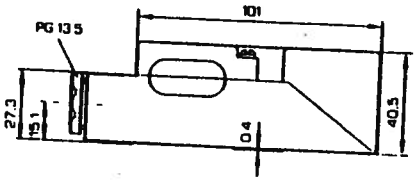
Concerning Safety . . . **efector** makes every effort to build a dependable product, but every product will eventually fail and so your equipment must be designed to prevent property damage and personal injury if our products fail

Technical Data at + 20°C

	DC PNP	DC NPN	AC/DC dual voltage
operating voltage	10-36 V DC incl. residual ripple	10-36 V DC incl. residual ripple	20-250 V AC 50-60 Hz 20-250 V DC
max. load current continuous:	250 mA short-circuit and overload protection	100 mA	350 mA AC to + 50°C 250 mA AC at + 80°C 100 mA DC
inrush:	250 mA	100 mA	1:2.2 A/20 ms at f: 0.5 Hz
voltage drop	< 2.5 V at max. load	1 V	< 6.5 V AC; < 6.0 V DC at max. load
leakage current (2 wire)			< 1.3 mA at 120 V AC < 0.8 mA at 24 V DC
supply current (3 wire)	< 5 mA at 24 V	< 5 mA at 24 V	
min. load current			5 mA
max. switching rate	350 Hz, 15 mm f 350 Hz, 20 mm nf	350 Hz, 15 mm f	20 Hz at AC 55 Hz at DC
switching status indication	LED	LED	LED
housing rating	IP 65 ⊡ NEMA 3, 4, 12, 13 (when used with cables from .25" OD thru .5" OD)		
ambient temperature	-25°C to + 80°C (-13°F to + 176°F)		
nominal sensing range s_n	**15 mm, flush mountable; 20 mm, non-flush mountable**		
switching hysteresis	3% – 15% of the sensing range		
correction factors (approx.)	mild steel 1; stainless steel 0.7; brass 0.4; aluminum 0.4; copper 0.2		
switch point drift/repeatability	< ± 10% of s_r over entire temperature range and voltage range/< 1%		
housing	plastic; Noryl		

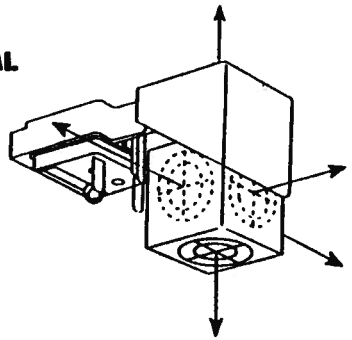
Dimensions





Design/Mounting Instructions

MECHANICAL

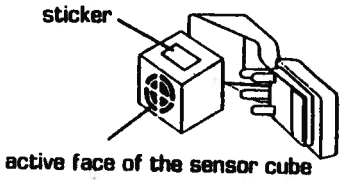


Mounting:

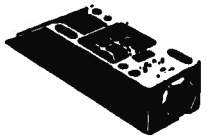
There is an internal five position sensing cube which allows the sensor active zone to be on top or any of the four sides. Mount the unit so the LED is clearly visible as a maintenance aid.

Locate the proximity switch as close as possible to the object to be sensed, staying within the nominal detection range. Mount the switch using 10-32 screws or bolts through the four (4) mounting holes.

To set the position of the active face:
Unscrew the switch unit of the proximity switch. Draw the sensor cube out of the switch unit and then re-insert it so that the active face points to the target material.



Switch unit



Mounting base

Design/Mounting (continued)

For Non-flush Mount Model IME2020 and IME3020:
When the proximity switch is mounted on a metal surface, the face of the cube marked by a sticker must point to this metal surface. (Not required when the active face is directly opposite the metal mounting base.)

Normally Open/Normally Closed Programming:
On the inside of the cover is a wire link used to select normally open (N.O.) or normally closed (N.C.) switch mode. Uncut, the wire provides N.O. programming. To program N.C., cut the wire link with wire clips. Remember to apply the self-adhesive bullseye to the proximity switch to indicate the sensing surface.

wire link
normally open

wire link
normally closed

ELECTRICAL

DO NOT test the unit with a lamp load higher than 6 watts on the AC unit since inrush current could damange the unit. **DO NOT** use a lamp load to test a DC switch without consulting factory.

DO NOT operate this unit without a load (for example, plugged into a wall outlet).