

Foxhole Slip Assembly



Customer References

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Rig / Hull: **NDC 9**

Tag Number: **N/A**

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CHANGE DESCRIPTION

Revision	Change Description
01	Initial Release

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Functional Design Description Foxhole Slip Assembly

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NATIONAL OILWELL VARCO

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C	Where changes have been made in old requirements, a bold vertical line appears in the margin of the paragraph affected as shown.
D	Where changes have been made in old requirements, a bold vertical line appears in the margin of the paragraph affected as shown.
E	Added optional switch to description.

1. Introduction

The Foxhole[®] Slip Assembly (FSA) is Varco System's latest answer to the challenging demands of offshore drilling. It is a remotely operated slip to assist with off line stand building. It sits on top of the Foxhole and flush with the rig floor when not in use. It is secured to the rig structure enabling it to vertically retain tubulars when making up or breaking out. Its scope also includes a pneumatic control plate assembly consisting of air filter, pressure regular, lubricator, solenoid valve and J-box.

2. Description

2.1 Major components

- Body - The Body is the main component of the assembly, which interfaces with the Foxhole and to which the other components mount. Its main feature is the 6 sets radially arranged slip guides, with a slip angle of 11°.
- Leveling beam - This is the moving element of the assembly. It attaches to the Body with 3 guide rods and is raised and lowered with 3 pneumatic cylinders. Slip assemblies connect to the leveling beam through hanger brackets and are raised and lowered by the beam.
- Hanger Brackets - Six Hanger Brackets install in slots in the Leveling Beam and support the slip assemblies. The brackets are designed for quick change of the slips to a different size.
- Slip assemblies - Six slip assemblies hang from the Leveling Beam. Each assembly has a pair of rollers which ride on the slip guides as they are raised and lowered by the Leveling Beam.
- Pipe centralizer guide - This keeps the tubular centralized in the center of the Foxhole[®] Slip Assembly. A cover plate installs on the pipe guide and Cover protects the assembly when not in use and removes a trip hazard.
- Control panel. - The control panel installs remote from the FSA and controls the air supply to the pneumatic cylinders.

The following safety features are included in the FSA design:

- Safety cover - When not in use, the FSA has a cover to prevent a trip hazard.
- Loss of air – The FSA will automatically close / set.
- An optional intrinsically safe switch attached to the body detects when the levelling beam is down.

2.2 Control System

2.2.1 Control Module

There is no dedicated control system for the FSA, it is usually connected to the AUX controller which consists of an industrialized Control Module. All communication with the AUX controller is via Ethernet or a Profibus DP bus operating at 1.5 MHz. The tool uses remote I/O modules for communicating the control system.

2.2.2 Control Station

The operator interface / control station can be provided via a Varco Operator Control Console or an HMI interface such as VICIS. Command signal communication from the operators control station to the tool controller will be Profibus DP and / or Ethernet. When the VOCC is switched on, the FSA can only be controlled from the VOCC. When V-ICIS is present, the FSA can be controlled from either the driller's chair or the assistant driller's chair.

2.2.3 Drive Systems

The FSA is powered using a standard electro-pneumatic solenoid valve.

3 Design Data

3.1 Specifications

	<u>14" Foxhole Slip Assy</u>	<u>20" Foxhole Slip Assy</u>
• Tubular Diameter (inches)	3-1/2 – 14	2-3/8 - 20
• Tubular Weight, max (Lbs)	22,000	30,000
• Available Slip Sets (inches)	3-1/2 – 8-1/4	2-3/8 – 6-1/2
•	5 – 9-3/4	5 – 9-3/4
•	9-5/8 – 14	9-5/8 – 14
•	-	16 - 20
• Cycle Time, Locate and Set (sec)	20	20
• Cycle Time, Release (sec)	5	5

Slip Sets – The FSA must be manually configured with the proper slip set for the size range of tubular being handled.

Back up torque – The FSA can provide only minimal back up torque. It can provide backup for spinning and shouldering, but cannot provide backup for making or breaking connections.

3.2 Environmental

	Operating	Ocean Wet Towage	Location Move
Wind:	20 m/sec	51.5 m/sec	36 m/sec
Temperature:	-20°C to +50°C	-20°C to +50°C	-20°C to +50°C
Pitch/Roll amplitude	None	±15°	±10°
Pitch/Roll period	n/a	15 sec	15 sec
Heave	n/a	n/a	n/a
Heave period	n/a	n/a	n/a
Center of rotation	n/a	30 m	15 m

Note: Ocean Wet Tow and Location Move are non-operational conditions.

4. Design Codes and Verification

The FSA operates above the drill floor at the foxhole. The area immediately around foxhole is a zone 2 area, the rest of the drill-floor, with exception to the well center area, (a 1.5m radius immediately around the well center), is classified as a zone 2 area. The zone 2 area extends up to the top of the drill-floor wind-wall. The FSA is designed to operate in a zone 2 hazardous area. All electrical equipment mounted on the FSA tool is certified for zone 2.

The FSA is not to be used at well center.

4.1 Relevant Codes and Standards

- “Rules for Certification - Lifting Appliances” DNV, (1989)
- “Code for Lifting Appliances in a Marine Environment” Lloyd’s Register of Shipping, (1987)
- “Specifications for Structural Steel Building - Allowable Stress Design and Plastic Design”, AISC, (June 1, 1989)
- Varco Dynamic Design Loading Specification

4.2 Design Verification

Design is subject to third party verification by a recognized certifying authority, usually designated by customer requirements.

5. Design Philosophy

5.1 General Approach

The design is intended to provide semi-automatic, remote controlled holding and releasing of drill pipe, drill collar and casing singles during stand building and breaking operations. The design utilizes experience gained from existing foxhole slip assemblies in operation. Structural components of the FSA are design to withstand the static, dynamic and fatigue loads likely to be imposed during its life time. The design and analysis of structural components are performed using design safety factors and methods specified in the DnV specification “Rules For Certification of Lifting Appliances.” Loading criteria is defined in the “NOV Dynamic Design Loading Specification”. When applicable, more stringent environmental loading is taken from the customer’s specifications.

5.2 Design Life

The design life of the FSA system is 100,000 open / close cycles over a 20 year operating life. These cycle values correspond to an average drilling program consisting of 10,000 ft. wells, tripping every 2 days with 3 stands of drill collars in the string. On parts where fatigue damage is likely to occur, the stresses will be shown to be below the fatigue limit under operational load conditions. A lubrication and maintenance program, combined with routine change out of wear components like bearings for motors and gears, will maintain the unit in peak operational condition for its design life.

5.3 Material & Component Selection

All material selection decisions are based on fitness to the application as defined above, availability, manufacturability, serviceability, cost, and standardization with respect to other Varco products. In addition, the following will be considered:

Structural components - chosen on basis of strength, durability, and resistance to stress. Material to be selected from family of existing Varco Material Specifications to the extent practicable, with tractability appropriate to the application

Pressure containing components (e.g. hoses, accumulators, cylinders): to be commercially available with appropriate service ratings.

Fasteners, fittings - Materials are resistant to the environment, through either sacrificial coating scheme or other environmentally resistant properties.

Non-metallic seals - commercial seals, chosen on basis of chemical and environmental resistance, and long service life.

Electrical System / Components - Reference "Electrical Standards" design specification 3DS00079 and "Electrical Documentation Standards" DS00072

Control Panel & Electrical System

The FSA utilizes (IEC / CENELEC) Ex electrical components and is constructed according to IEC standards for marine applications. All hazardous area equipment is certified for zone 1, exterior mounted safe area equipment is all designed for a marine application. All hardware is rated for IP 56 min and -20°C to $+50^{\circ}\text{C}$. The control system is housed in an IP 44 Rittal enclosure and is designed to be located in a non-hazardous area. The control system is based on a NOV Control Module and includes all necessary software to control the tool, programmed sequential control and operational interlocks for both operator and tool safety. The Control Module system is based on Profibus DP serial communications for tool field equipment where the remote I/O technology minimizes derrick and tool cabling and provides the flexibility to utilize smart type sensors / devices. Control Module peer-to-peer communications and interface to a higher level network for operator control is accomplished via Ethernet communications and Profibus DP. Enclosure: 600mm wide x 600mm deep x 2100mm high

The AUX control system has four connections to other electrical systems.

- Power supply: The control system requires a 230vac single phase power supply @ 5A. This supply is used by the control system for all power with the exception of the single board computer, which is on a separate UPS power supply.
- UPS power supply: The control system requires a 230vac single phase UPS power supply @ 1A. This supply is used only for the single board computer.

- Ethernet data connection: Data transfer is provided to other systems is via a Cat 5 copper Ethernet cable, which can be run from control system to control system, and possibly to another network. All Varco equipment controllers have similar data connections and may be connected via redundant fiber optic link when required. This provides data communications between NOV control systems and to/from a higher level network if necessary.
- Emergency Stop: All individual E-Stop circuits are hardwired back to the control system. These E-Stop signals are connected in series in the control system enclosure, and if they are all healthy a signal is made available for external purpose, E-Stop healthy. These signals are generally monitored by a supervisor system for diagnostic purpose and to inform operators of E-Stop status for each tool. Additionally, there is a contact on the control system power isolator switch, which, if the control system is isolated for maintenance, sends the E-Stop circuit healthy, allowing other associated control systems to operate normally.

The FSA design takes into account the hazardous area classification of a particular drilling operation. Electrical and control system designs will be chosen that satisfactorily meet or exceed the conditions for safe operation within the respectively classed areas. Rig floor level systems may be subject to more stringent levels of classification than derrick mounted systems. Standard components will be used as practicable.

5.4 Control System

The Control Module (CM) receives inputs from various electrical sensors, encoders, operator interfaces, and other devices mounted on the tool or operators station. Command inputs to the CM from the operator's station result in outputs to drive the tool. The CM provides interlock control of various tool functions monitors sensor and encoder feedbacks. In general, the system of programmed interlocks provides a safety net to help prevent inadvertent damage, and are not relied on as a primary operating system. The operator is ultimately responsible for safe operation.

5.5 Failure Modes

In general, the FSA mechanical, electrical, and hydraulic systems are designed to provide the least obstructive or destructive failure mode. In general, electrical devices are chosen to assure failsafe mode in order to force the operator to make a decision before proceeding further.

Hydraulic systems are fitted with solenoid operated and load-holding valves as applicable to assure safe handling of loads in the event of failure.

6. Functions & Operations

6.1 General Operation

General operation of the FSA is defined as manual, where operator is in constant control of the FSA through use of the VOCC or HMI screen and / or some other controls. The primary function of the Foxhole[®] Slip Assembly is to support tubulars in the Foxhole during stand making operations. The assembly opens to load/unload tubulars and closes to set the slips. The slip sets must be manually changed in order to support tubulars larger or smaller than their specified range. The following mechanical functions are used to operate the machine(s):

- Foxhole Open – Opens the Foxhole Slip Assembly.
- Foxhole Close – Closes the Foxhole Slip Assembly.

6.2 Changing Modes

Modes of operation may be changed anytime during operation, however, interlocks will be enforced to prevent damage to the equipment.

- FSA Open – Used anytime through operator discrete control or touch screen.
- FSA Close – Used anytime through operator discrete control or touch screen

6.3 Interlocks

There are no interlocks currently programmed for operation of the FSA.

6.4 Configuration

There are no base level services or parameters configurable for the FSA.

6.5 Modification Facilities

There are no modification facilities for the FSA.

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		Commissioning Procedure Foxhole Slip Assembly, 14"	FIP00058	B
		Foxhole Slip Assembly Service Manual	SM00966	-
		The Use of and Application of Safety Wire for Secondary Retention	ASP00019	A
		Design Torque Standard	DS00008	G

Field Installation Procedure

FOXHOLE[®] SLIP ASSEMBLY, 14"

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CHANGE DESCRIPTION

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-	First Issue
A	Reformatted procedure
B	Changed Date structure

1.0 Scope

This procedure describes the installation of the 14 in. Foxhole® Slip Assembly. All necessary information for rig preparation is shown in the General Arrangement drawing.

2.0 Reference Drawings

Refer to the Technical Drawing Package for the following drawings:

General Arrangement, FSA
Pneumatic Interconnect Diagram
Electrical Interconnect Drawing

3.0 Pre-Installation

- Mousehole installed with FSA cutout and support structure as shown on GA.
- FSA operating envelope, shown on GA, clear of obstructions.
- Electrical cabling to Control Plate installed.
- Pneumatic piping to Control Plate installed.
- Air hoses from Control Plate to FSA, Customer provided.
- Control Plate mounting location prepared, including mounting holes.
- Storage area for slip assemblies prepared.

4.0 Unpacking, Handling and Initial Inspection

- Remove the component/assembly from the crate.
- Remove the protective covering from the component/assembly.
- Remove the tape from any surfaces.
- Remove any remaining adhesive, using a clean cloth and solvent
- Remove any nonessential oil or grease used as a protective coating for shipment and/or storage.
- Do not remove protective caps from electrical connectors or hydraulic/pneumatic fittings until installation.
- Inventory all components/assemblies.
- Inspect all components/assemblies for damage or corrosion beyond reasonable limits.

5.0 Installation

5.1. Control Plate Installation

- Install the Control Plate and secure using ½ in. hardware, customer provided.
- Verify that the J-Box is properly grounded.
- Terminate the J-Box with the cable as shown in the Electrical Interconnect Diagram.
- Connect rig air using ½ in. Male NPT fittings, customer provided.
- Connect FSA supply hoses, customer provided.
- Verify that the lubricator bowl is filled with SAE10 mineral based oil.

5.2. Foxhole Installation

- Hoist the FSA using the lifting holes provided in the top of the assembly and center over the Mousehole.
- Rotate the FSA to align its locating holes (on the bottom) with the locating pins on the support structure. NOTE: The locating pins are sized to orient the FSA to align with the pneumatic connections.
- Connect the pneumatic hoses to the FSA.
- Lower the FSA into the Foxhole.
- Verify that the locating pins are properly engaged with the mating holes in the FSA.

6.0 Set Air Pressure

The air pressure is to be set to the minimum required to reliably open the Foxhole Slip Assembly. Adjust the air pressure as follows:

- Install the largest set of slips to be used.
- Set the air pressure regulator on the Control Plate to maximum and cycle the Foxhole Slip Assembly up and down at least 10 times.
- Reduce the air pressure to less than 50 psi.
- While commanding the FSA to raise, slowly increase the air pressure until the FSA just barely opens.
- Adjust the air pressure to the minimum required to raise the slips in about 1.5 seconds.
- Record the minimum opening pressure. _____ psi

7.0 Test with Drill Pipe

- Fully close the FSA.
- Stab a joint of drill pipe (any size) into the Foxhole and close the FSA.
- Verify that the pipe is properly secured in the FSA.

Commissioning Procedure Foxhole Slip Assembly, 14”

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NATIONAL OILWELL VARCO

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CHANGE DESCRIPTION

Revision	Change Description
-	First Issue
A	SEE DCN
B	Updated document format

Commissioning Procedure for Foxhole Slip Assembly

1.0 Scope

The following defines the tests to commission the Foxhole Slip Assembly (FSA).

The FSA is a remote controlled slip assembly that sits on top of the mousehole and is recessed so that the top of the assembly is flush with the drill floor when in the stored position. It is used for making up stands off line and can accommodate 3 ½ to 14 inch tubulars.

2.0 Pre-commissioning Inspections

- ___ 2.1 Verify the working zone of the equipment/hardware is clear of all obstructions to prevent interference or damage during operation.
- ___ 2.2 Inspect the equipment/hardware and verify it is completely installed, free from damage, and there are no loose or missing bolts, nuts, locking devices, safety wire, etc.
- ___ 2.3 Verify the equipment has been properly lubricated.
- ___ 2.4 Verify that the tool has been installed and set up per the installation procedure.

3.0 Tools/Equipment Required

Single Joint of pipe, any size within the range of the slip sets.

4.0 Commissioning Tests

- ___ 4.1 Verify the air hose and quick disconnects are firmly attached.
- ___ 4.2 Turn on the power to the mousehole spider.
- ___ 4.3 Cycle the mousehole spider control switch to Open and Close for a minimum of 5 cycles.
- ___ 4.4 Verify that the mousehole spider is operating correctly in relation to the operator switch position, i.e. the spider is in the up position when the switch is in the raised (Open) position; the spider is in the down position when the switch is in the "slips set" (Closed) position.
- ___ 4.5 Set the control switch to open and verify that it takes at least 1.5 sec. To open.
- ___ 4.6 Install a joint of pipe and close the slips. Verify that the slips properly secure the pipe.
- ___ 4.7 Open the slips and verify that the pipe remains secure.

Completion Acknowledgment

The undersigned representatives hereby acknowledge that all checkout and testing work as listed herein, has been successfully completed. This acknowledgment is sufficient for the initiation of NOV's warranty coverage effective from the date listed below. The acknowledgment in no way relieves NOV of its responsibility for the equipment and workmanship.

_____ <i>Name</i>	_____ <i>Signature</i>	_____ <i>Date</i>
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_____ <i>Customer Name</i>	_____ <i>Signature</i>	_____ <i>Date</i>
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_____ <i>Customer</i>	_____ <i>Project</i>
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NATIONAL OILWELL VARCO

FSA

Foxhole Slip Assembly Service Manual

SM00966

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Information in this manual is subject to change without notice.

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Glossary

Intended audience

This manual is intended for use by field engineering, installation, operation, and repair personnel. Every effort has been made to ensure the accuracy of the information contained herein. Varco International, Inc., will not be held liable for errors in this material, or for consequences arising from misuse of this material.

Conventions

Notes, cautions, and warnings

Notes, cautions, and warnings are used throughout this manual to provide readers with additional information, and to advise the reader to take specific action to protect personnel from potential injury or lethal conditions. They may also inform the reader of actions necessary to prevent equipment damage.

Please pay close attention to these advisories.

Note:



The note symbol indicates that additional information is provided about the current topics.

Caution:



The caution symbol indicates that potential damage to equipment or injury to personnel exists. Follow instructions explicitly. Extreme care should be taken when performing operations or procedures preceded by this caution symbol.

Warning:



The warning symbol indicates a definite risk of equipment damage or danger to personnel. Failure to observe and follow proper procedures could result in serious or fatal injury to personnel, significant property loss, or significant equipment damage.

Illustrations

Figures provide a graphical representation of equipment components or screen snapshots for use in identifying parts or establishing nomenclature, and may or may not be drawn to scale.

For more specific component information pertinent to your rig configuration, see the technical drawings included with your Varco documentation.

Safety requirements

Varco equipment is installed and operated in a controlled drilling rig environment involving hazardous operations and situations. Proper service and repair is important for safe and reliable operation. Operation and service procedures provided by Varco manuals are the recommended methods of performing those operations.



CAUTION: To avoid injury to personnel or equipment damage, carefully observe the following safety requirements.

Personnel training

All personnel performing installation, operations, repair, or maintenance procedures on the equipment, or those in the vicinity of the equipment, should be trained on rig safety, tool operation, and maintenance to ensure their safety.



CAUTION: During installation, maintenance, or repair of equipment, personnel should wear protective gear. Protective gear must be worn during certain operation.

Contact the Varco Drilling Equipment training department for more information about equipment operation and maintenance training.

Recommended tools

Service operations may require the use of tools designed specifically for the purpose being described. Varco recommends that only those tools specified be used when stated. Ensure that personnel and equipment safety are not jeopardized when using service procedures or tools not specifically recommended by Varco.

General system safety practices

The equipment discussed in this manual may require or contain one or more utilities, such as electrical, hydraulic, pneumatic, or cooling water.



CAUTION: Before installing or performing maintenance or repairs on equipment, read the following instructions to avoid endangering exposed persons or damaging equipment.

- ❑ Isolate all energy sources before beginning work.
- ❑ Avoid performing maintenance or repairs while the equipment is in operation.
- ❑ Wear proper protective equipment during equipment installation, maintenance, or repair.

Replacing components

- ❑ Verify that all components (such as cables, hoses, etc.) are tagged and labeled during disassembly and reassembly of equipment to ensure correct installment.
- ❑ Replace failed or damaged components with Varco certified parts. Failure to do so could result in equipment damage, or personal injury.

Routine maintenance

Equipment must be maintained on a regular and routine basis. See the service manual for maintenance recommendations.



CAUTION: Failure to conduct routine maintenance could result in equipment damage or injury to personnel.

Proper use of equipment

Varco equipment is designed for specific functions and applications, and should be used only for their intended purpose.

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General Information

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Description

The Foxhole[®] Slip Assembly, referred to herein as the FSA, is a remote-controlled slip assembly that sits on top of the Foxhole[®], recessed so that the top of the FSA is flush with the drill floor when in the stored position. The FSA is used for making up stands off line. A permanent (customer supplied) platform provides a stable base on which the FSA rests. (See the Foxhole[®] Slip Assembly drawing for a recommended example of the platform.)

The FSA accommodates 3 1/2 to 14 in. tubulars by applying one of three different slip sets.

This assembly can be used whether or not the Foxhole[®] contains an automatic hoist assembly.



Major components

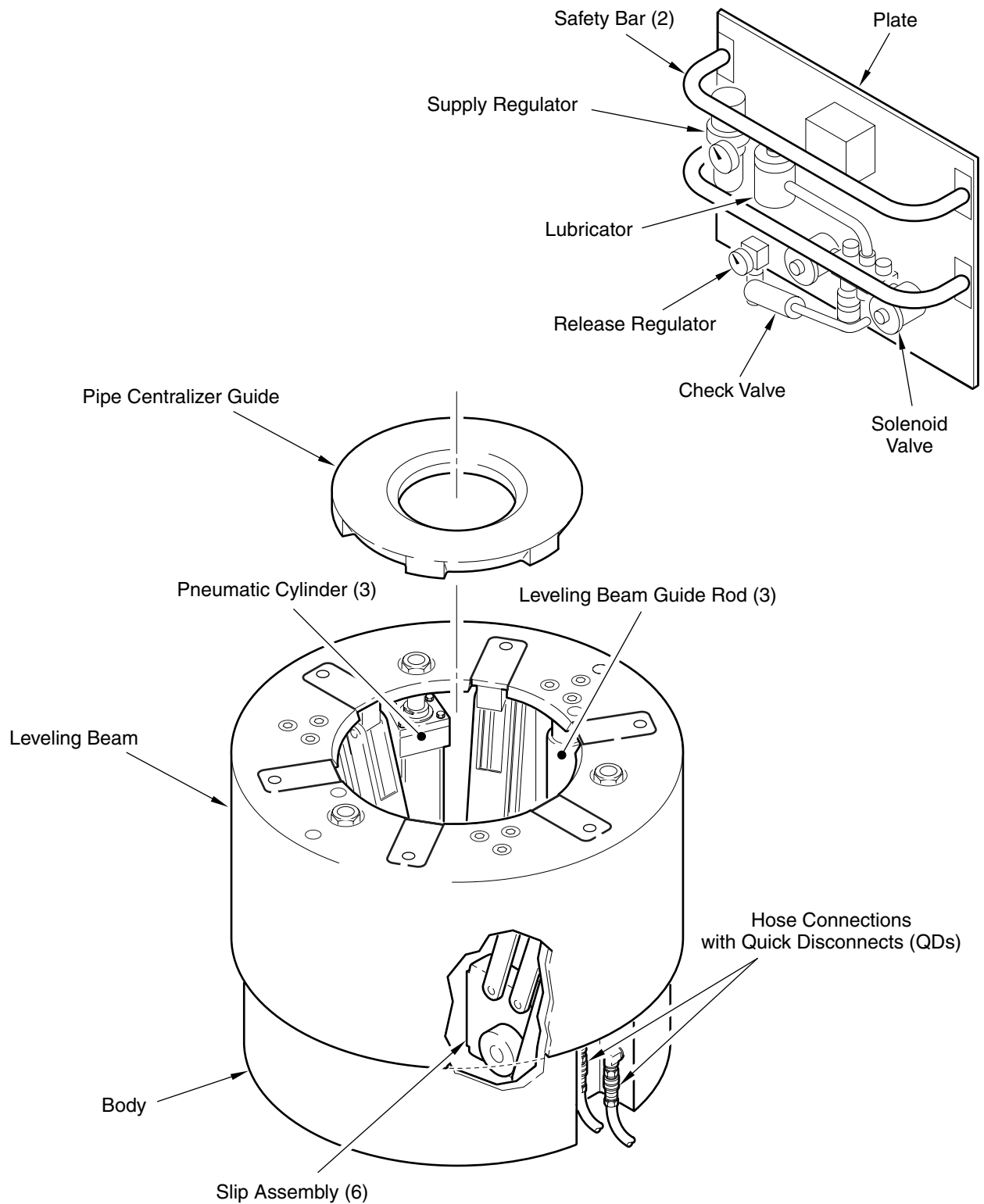
The FSA consists of the Foxhole® Slip Assembly and a pneumatic control plate assembly, which the customer installs in the derrick. The control plate is supplied with electrical and pneumatic power, as required. The customer also supplies two 1/2 in. pneumatic lines from the control plate assembly to the FSA.

On shipment, the FSA accommodates tubulars from 5 to 9 3/4 in. outside diameter (OD). Additional slip sets are available for handling tubulars from 3 1/2 to 8 1/4 in. and from 9 5/8 to 14 in. OD.

The FSA consists of the following items:

- ❑ Foxhole® Slip Assembly
 - ❑ Leveling beam and guide rods
 - ❑ Pipe centralizer guide
 - ❑ Slip and hanger assemblies
 - ❑ Pneumatic cylinders
 - ❑ Hose assemblies
 - ❑ Cover plate
- ❑ Control plate assembly
 - ❑ Release regulator
 - ❑ Supply regulator
 - ❑ Solenoid control valve
 - ❑ Lubricator
 - ❑ Check valve
 - ❑ Mounting plate

Major components

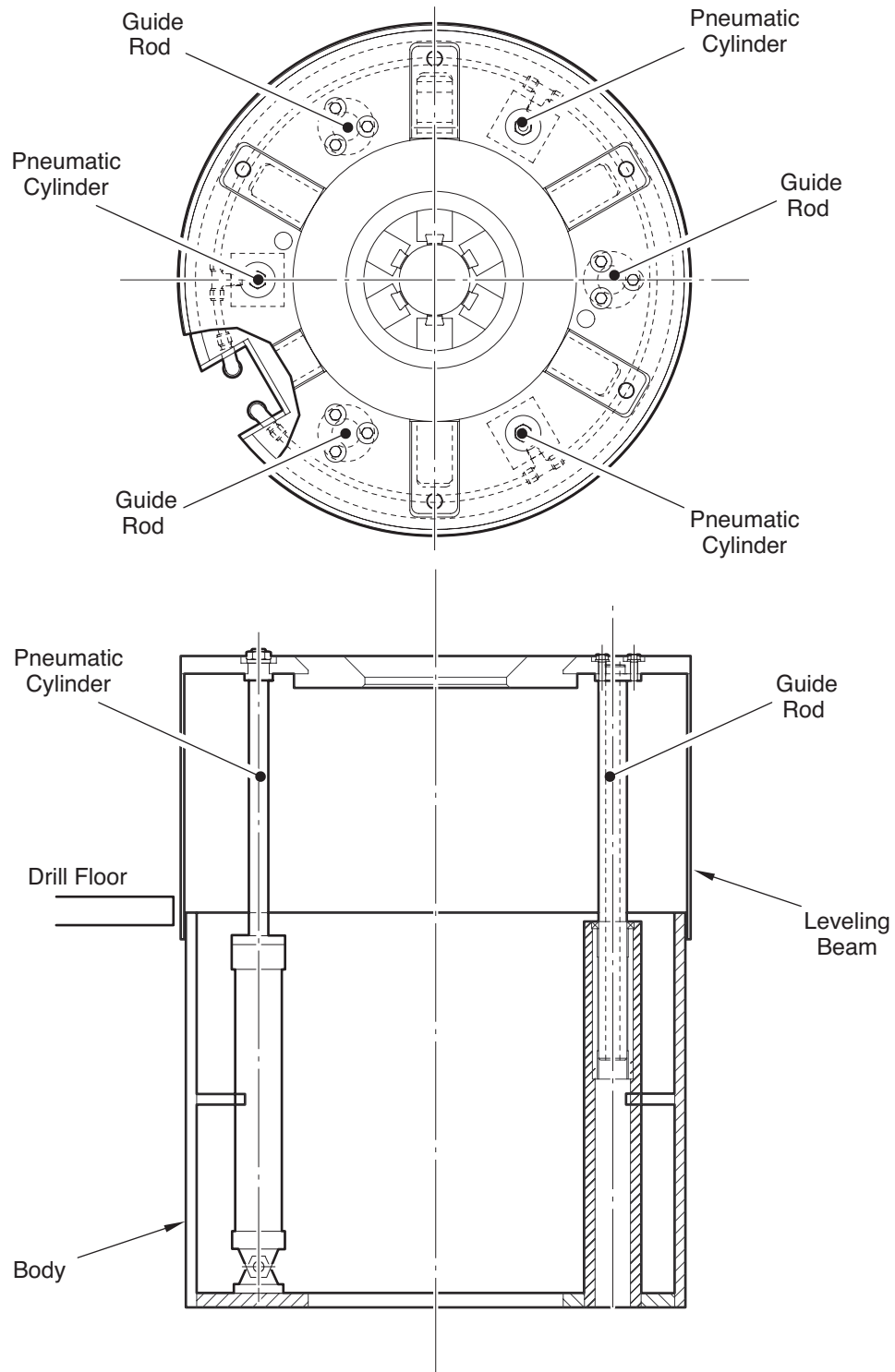




Leveling beam, guide rods, and pneumatic cylinders

The slip assemblies connect to the leveling beam by slip hanger brackets. The leveling beam is supported by three pneumatic cylinders and guided by three guide rods. When the leveling beam is lowered, the slip assemblies are centralized to grip the tubular correctly.

Leveling beam, guide rods, and pneumatic cylinders





Slip and hanger assemblies

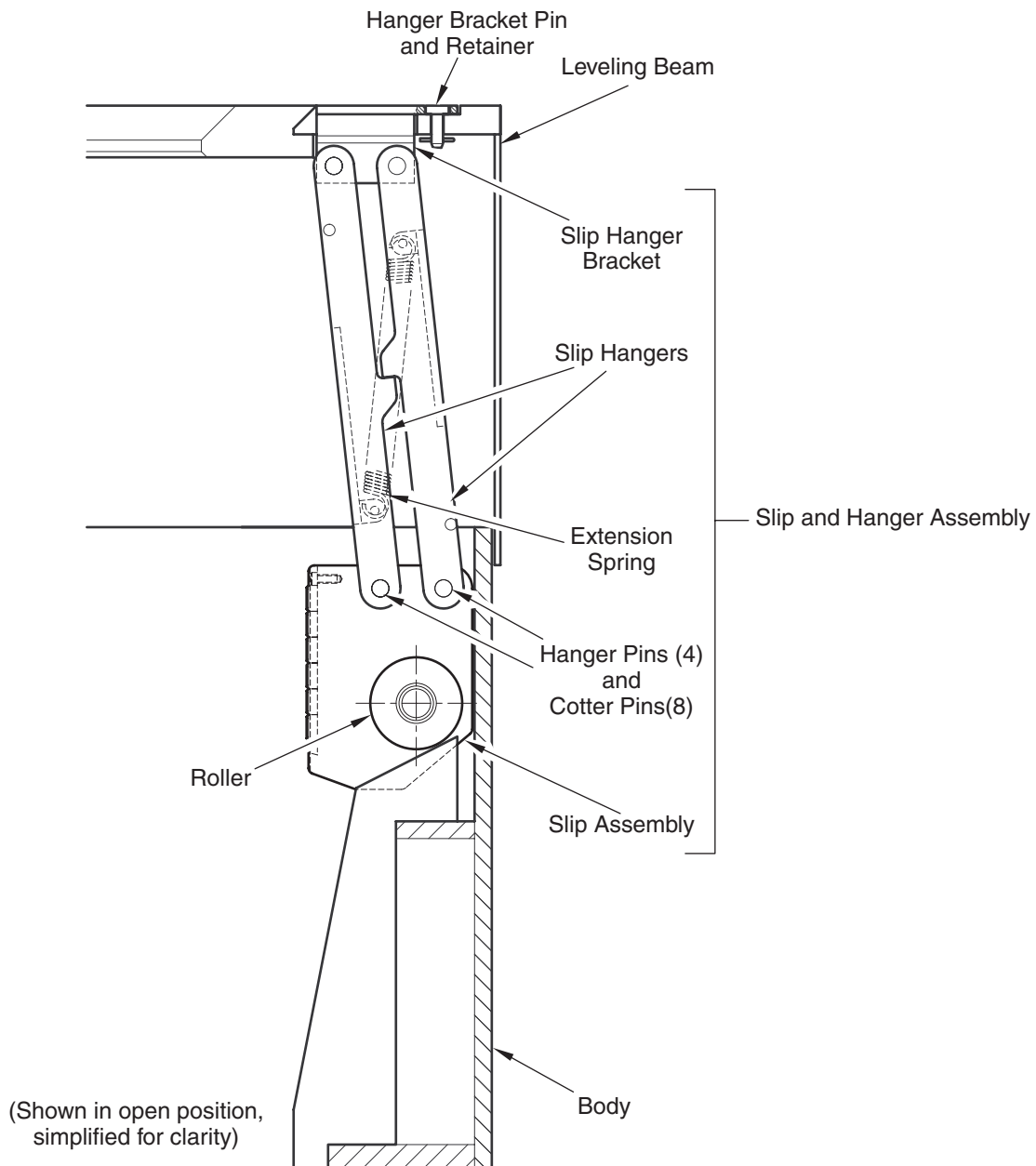
Three sets of slip and hanger assemblies enable the FSA to accommodate the following tubular ranges:

- ❑ 3 1/2 to 8 1/4 in.
- ❑ 5 to 9 3/4 in.
- ❑ 9 5/8 to 14 in.

The air-operated slip assembly grips or releases the tubular in the Foxhole® during stand building. Six roller-equipped slips are arranged in 60° increments around the circumference of the FSA. The rollers move up and down on guide plates as the slips are raised or lowered. These rollers require no lubrication. The slip and hanger assembly consists of two slip hangers joined by extension springs, which attach to the slip assembly by means of a slip bracket, hanger, and cotter pins. The extension springs connecting the two slip hangers allow the slips to retract and set, when the leveling beam is raised. The slips remain retracted when raised, regardless of platform or vessel motion.

Accommodating various tubular sizes

The slip and hanger assemblies attach to the leveling beam with the hanger bracket pin. To accommodate various tubular sizes, remove the slip and hanger assemblies and replace with the desired size. (See Changing out the slip assemblies on page 12.)





Operation overview

Operator controls

A two-position detent switch located on the driller's control panel allows the operator to raise and set the slips within the FSA.

Operating considerations

The FSA should be used only when building stands off line.



When operating the FSA, always set the slips before making up or breaking out connections.



The FSA is not designed to provide back up torque for making or breaking out connections. This tool is intended only to support vertical tubular loads. Connections must be backed up independently to avoid damage to the FSA and/or dropped pipe.



Under light loads, it is normal that not all six slip assemblies contact the outside diameter (OD) of the tubular. This is not a cause for concern.



FSA set up

Before each use, set up the FSA as follows:

1. Install the proper slip assemblies for the size of tubular being used.
2. Verify that the lubricator on the control plate assembly is full.
3. Adjust the pneumatic supply pressure to the maximum, using the supply regulator on the control plate assembly.
4. Adjust the release regulator on the control plate assembly to the *minimum* required to raise the leveling beam.



Setting the release pressure too high could cause the pipe to release.

5. Cycle the FSA 5 to 10 times to insure proper lubrication of the cylinders before allowing it to support weight.

Operation overview

Operational sequences

This section describes general operational sequences of the FSA.

General tool sequence

The operational sequence is as follows:

1. Using pipe-handling equipment, lower a tubular into the FSA.
2. Set the control switch to CLOSE. This lowers the slips, so that the Foxhole® Slip grips the stand in the Foxhole®.
- 3.

Building stands

The following sequence describes how to build double and triple stands using the FSA.

1. Open the slips.
2. Lower the first tubular into the Foxhole® to the appropriate connection height.
3. Set the slips to grip the tubular.
4. Release the pipe-handling equipment after verifying that the slips have taken the load.
5. Present a second tubular over the Foxhole® and make the connection to the required torque (using separate back-up).
6. Using pipe-handling equipment, latch onto the double, open the slips, and hoist.



When raising the load, set the control switch to OPEN only after the tubular begins hoisting.

Repeat the process once more for building a triple.



Operation overview

Changing out the slip assemblies

To accommodate various tubular sizes, you must change out the slip and hanger assemblies and replace with the correct size.

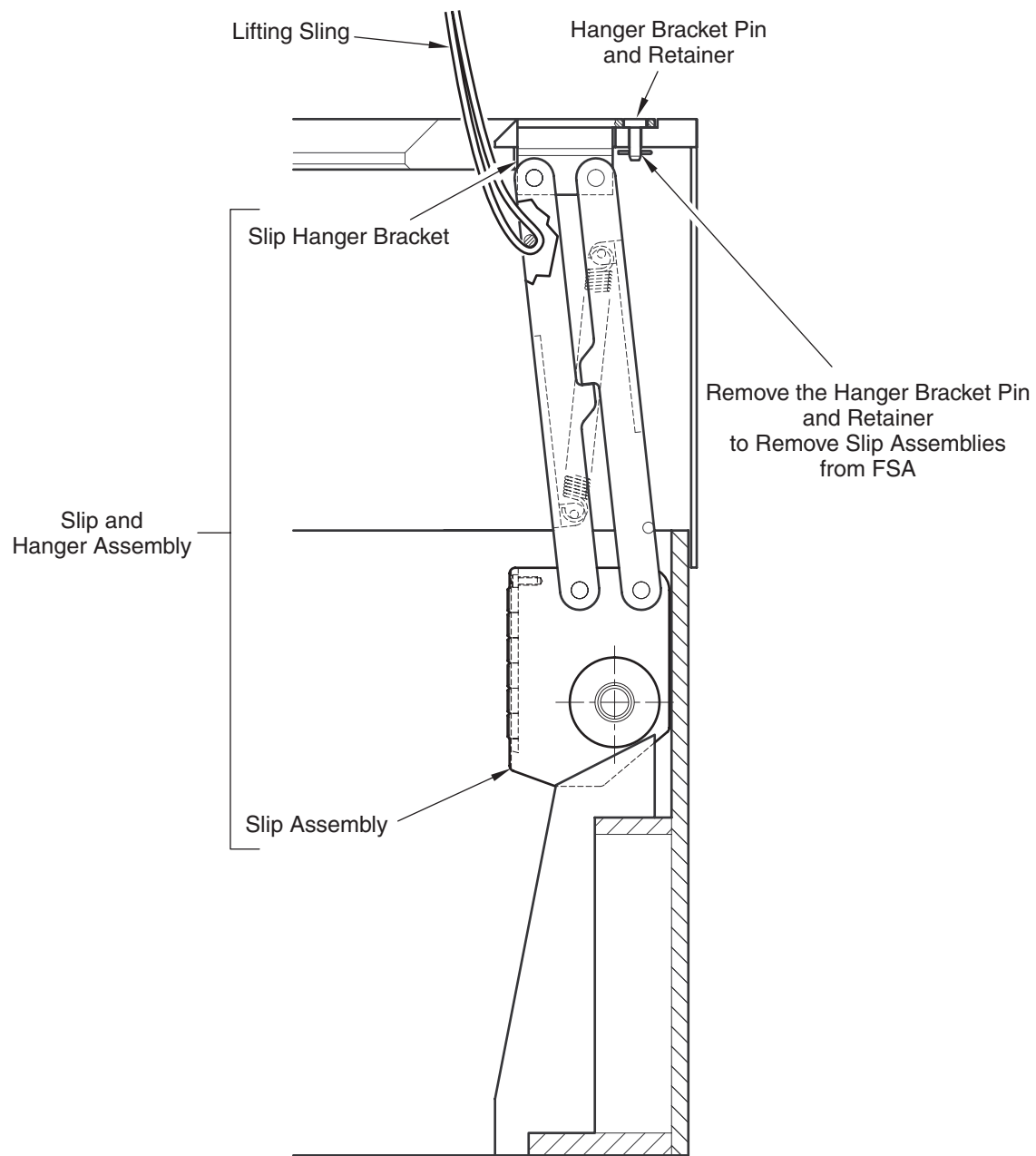


Before you start, attach a lifting sling to the slip hanger to be removed.

1. Remove the hanger bracket retainer and pin.
2. Slide the slip and hanger assembly out of the FSA.
3. Repeat steps 1 and 2 for the other five hanger and slip assemblies.
4. Install the different size hanger and slip assembly.
5. Replace the hanger bracket pin and retainer.
6. Repeat steps 4 and 5 for the other five hanger and slip assemblies.

Operation overview

1





Installation considerations

Installing the FSA involves the following:

1. Preparing the Foxhole®
2. Installing the FSA and connecting the control system.
3. Function testing the FSA

Preparing the Foxhole®

The FSA sits on top of the Foxhole®. Two 1 1/2 in. guide pins (Varco supplied) position the FSA in the proper location.

Installing the FSA

To install the FSA:

Position the FSA above the Foxhole®.

1. Connect the air lines. (See the pneumatic schematic in the Technical Drawing book.)
2. Lower the FSA onto the guide pins.

The FSA is held in position by its own weight. The guide pins assure the FSA is in the appropriate location to avoid fouling or damaging the air supply hoses.

Connecting the control system

See the Foxhole® Slips Installation Kit drawing for mounting instructions, and the Foxhole® Slips Interconnect Diagram located on the Installation Kit drawing in the Technical Drawing Package to connect the control system as follows:

1. Attach the control valve plate assembly to the rig structure.
2. Connect the rig air supply to the 1/2 in. NPT ball valve located on the control valve plate assembly.
3. Connect the rig electrical supply to the J-box located on the control valve plate assembly.
4. Connect the control valve plate assembly to the FSA with customer-supplied 1/2 in. air hoses.
5. Open the inlet ball valve adjacent to the supply filter/regulator assembly.
6. Set the supply filter/regulator to 90 psi.
7. Set the release regulator to the minimum required to raise the leveling beam.



Installation considerations

Function testing

To function test the FSA:

1. Make sure the air hose and QDs are firmly attached.
2. Turn on the power to the FSA.
3. Cycle the FSA control switch to OPEN and CLOSE several times.
4. Verify that the FSA is operating correctly in relation to the operator switch position, i.e., the FSA is in the up position when the switch is in the raised (OPEN) position; the FSA is in the down position when the switch is in the "slips set" (CLOSED) position.
5. Verify that it takes at least 1 1/2 seconds for the slips to raise.
6. If the slips raise up too fast in step 5, reduce the available pressure at the release regulator on the control panel assembly. Repeat step 5.



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Electrical specifications	2-3
Pneumatic specifications	2-3



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Specifications

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Specifications

Physical specifications

Size:	Height (Retracted)	29.0 in. (737 mm)
	(Extended)	46.0 in. (1,168 mm)
	Diameter	36 in. (914 mm)
Travel	Leveling beam	17 in. (432 mm)
Weight		2,600 lb (1179 kg)

Performance specifications

Tubular range	Diameter	3 1/2 to 14 in. in three ranges:
		• 3 1/2 to 8 1/4 in.
	(Three sets of slips are required to cover the full tubular range.)	• 5 to 9 3/4 in. • 9 5/8 to 14 in.
Load capacity	Safe working load (SWL)	22,000 lb (9988kg)

Electrical specifications

The air solenoid requires a 24 VDC control signal.

Pneumatic specifications

90 psi (6.1 BAR) minimum



Maintenance

General maintenance practices 3-3

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Maintenance

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General maintenance practices

Equipment maintenance records

Keep a record book of all maintenance procedures performed. Date each procedure, followed by a description and the technician who performed it. This data is valuable for fault finding and problem solving, should technical problems arise.



Procedures in this chapter relate to Varco only components. See the supplier manuals for maintenance procedures and schedules for the vendor equipment.

Safety precautions

Avoid equipment damage or injury to personnel by paying close attention to the important safety notes highlighted as Notes, Cautions, and Warnings used throughout this manual.

To avoid serious injury or death, read and understand the following Warnings before performing maintenance or troubleshooting procedures:



Unless instructed otherwise, properly lock out the main power source before performing any maintenance procedure.



Wear protective glasses to prevent eye injuries.



Do not attempt any adjustments while the machine is moving.



Read and understand all safety precautions and warnings before performing maintenance procedures.



Inspection procedures

The inspection procedures assume normal operating conditions. Some conditions (excessive loading, dusty or corrosive atmosphere, temperature extremes, etc.) may warrant more frequent inspection intervals. Perform the maintenance procedures indicated, as warranted by the inspection.

Inspecting load-carrying components

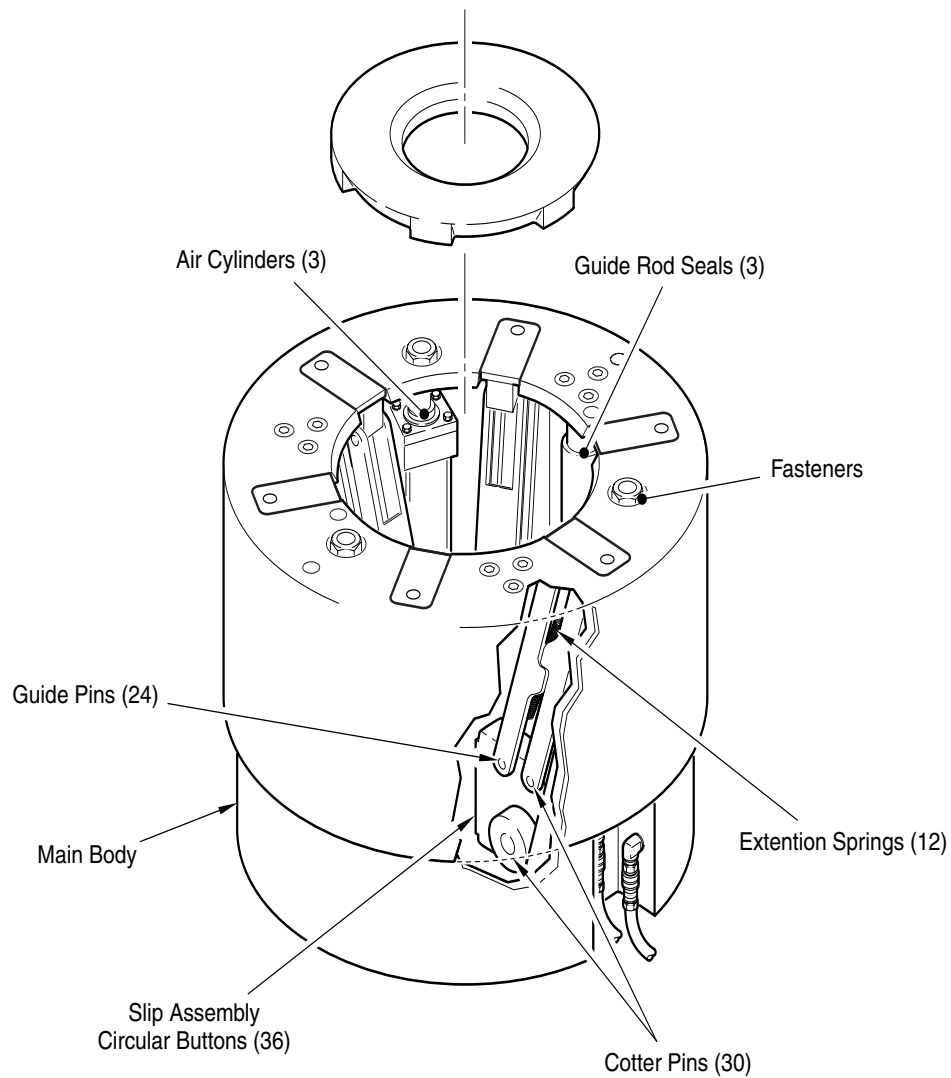
Because the load-carrying components are critical to performance, Varco recommends performing visual inspections on a regular basis.

Visually inspect all load-carrying components for corrosion, fatigue, or other deterioration. If you detect any excessive wear and tear on any component, replace the component.

The criteria for inspection of load-carrying components are determined by your installation manager and by local regulatory requirements.



Inspection procedures

3



Lubrication procedures



Failure to maintain adequate lubrication could result in equipment damage.



Failure to thoroughly clean grease fittings before applying grease can cause foreign matter to be injected into the fitting, causing equipment damage.

3

Recommended lubricants

Recommended hydraulic fluids

Manufacturer	-15° to 75° C (5° to 167° F)	-10° to 85° C (14° to 185° F)
Castrol	Hyspin AWS-32	Hyspin AWS-46
Chevron	AW Hyd oil 32	AW Hyd oil 46
Exxon	Nuto H32	Nuto H46
Gulf	Harmony 32AW	Harmony 46AW
Mobil	DTE 24	DTE 25
Shell	Tellus 32	Tellus 46
Statoil	Hydraway HMA 32	Hydraway HMA 46
Texaco	Rando oil HD32	Rando oil HD46
Total	Azolla ZS 32	Azolla ZS 46
Union	Unax AW32	Unax AW46
Viscosity Index		
ISO Viscosity Grade	32	46



Lubrication procedures

Recommended lubricants

Recommended general purpose lubricants

Manufacturer	Below -20° C (Below -4° F)	Above -20° C (Above -4° F)
Castrol	-	MP Grease
Chevron	Avi-Motive W	Avi-Motive
Exxon	Lidok EP1	Lidok EP2
Gulf	Gulf Crown EP31	Gulf Crown EP32
Mobil	Mobilux EP1	Mobilux EP2
Shell	Alvania EP1	Alvania EP2
Statoil	Uniway EP1N	Uniway EP2N
Texaco	Multifak EP1	Multifak EP2
Total	Multis EP1	Multis EP2
Union	Unoba EP1	Unoba EP2
Viscosity Index		
NGLI	1	2



Lubrication procedures

When in use, lubricate the following components every three or four days.

1. Extend the FSA to expose internal components.
2. Lubricate the leveling beam guide rods (3) by wiping the rods down and applying fresh waterproof grease.
3. Fill the lubricator on the control panel using SAE 10 mineral-based oil.

Troubleshooting

Troubleshooting fault symptoms 4-3

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Troubleshooting

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Troubleshooting fault symptoms

Potential component failures fall into the following categories:

- ❑ Electrical components
- ❑ Mechanical components
- ❑ Pneumatic components

To help determine the nature of the problem use the troubleshooting tables contained in this chapter.



The troubleshooting procedures in this chapter do not necessarily cover all possible symptoms. The tables provide an insight to typical symptoms, their possible causes, and which components to check as the most likely candidates causing the fault.

Running diagnostics

Diagnostics is a valuable troubleshooting tool. Use the instructions contained in the V-ICIS Users Manual to run diagnostics.

Helpful documents

The Technical Drawings Package contains assembly drawings for component locations, and electrical and pneumatic schematic diagrams for signal tracing.



Troubleshooting



Unless instructed otherwise, properly lock out the main power source before performing any maintenance procedure.

Symptom	Probable cause	Remedy
Slips fail to open or close without a tubular	No 24 VAC to pneumatic solenoid.	Turn on electrical power.
	Improper air supply to the FSA	Supply proper air pressure.
	Leaky air cylinder or air lines.	Check air cylinders and air lines.Repair or replace as necessary.
	Binding caused by bent or damaged guide rod or air cylinder.	Check guide rods and air cylinders. Repair or replace as necessary.
Slips fail to open while gripping a tubular	Excessive weight on the FSA	Reduce weight to the safe working load (SWL) of 22,000 lb (9988 kg).
	Improper air supply to the FSA	Supply proper air pressure.
	Leaky air cylinder or air lines.	Check air cylinders and air lines.Repair or replace as necessary.
	Binding caused by bent or damaged guide rod or air cylinder.	Check guide rods and air cylinders. Repair or replace as necessary.

Glossary

Definitions 5-3



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Glossary

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Definitions

The following are definitions of the acronyms, abbreviations, and terminologies that may be used in this manual. Standard acronyms and abbreviations, such as vac, vdc, in., ft-lb, etc., and industry-standard terminologies are not listed.

FSA - Foxhole® Slip Assembly

QD - QuickDisconnect connector on pneumatic hoses/lines

SWL - Safe Working Load.

TDP - Technical Drawing Package



PROCEDURE

THE USE OF AND APPLICATION OF SAFETY WIRE FOR SECONDARY RETENTION

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This procedure establishes the method for the selection and application of safety wire. Lock wiring is the application of wire to prevent relative movement of structure or other critical components subject to vibration, tension, torque, etc.

This procedure is intended to help eliminate the risk of dropped objects in components or parts manufactured.

Bolts, Nuts and Screws are the common type of fasteners used on NOV equipment. They need to be locked (secondary retention) against loss of torque / pre-tension.

Use of safety wire to prevent rotation of fasteners is a safe and **primarily recommended secondary retention method for fasteners**. It is the most preferred method because it not only prevents fasteners from loosening but also keeps them from falling in case of primary retention failure (bolt head Breaks off) and effectively prevents dropped objects.

Note that the **secondary retention will work only if the primary retention method is properly in place**, i.e. bolts and screws are tightened and torqued as per specifications, and there is no play between the mating elements. Secondary retention methods aim in preventing any compromise in primary retention, loss of pre-tension in assembled fasteners, loosening and backing out.

Definitions:

Secondary Retention – The means of effectively retaining a fastener/joining component such that the operating loads do not compromise the integrity of the primary fastening component.

2 APPLICABLE DOCUMENTS

DS00008-DES DESIGN TORQUE STANDARDS
Machinery's Handbook 27th Edition

3 REQUIREMENTS

3.1 MATERIAL AND SIZE

3.1.1 Material

Lock wire must be aircraft quality stainless steel 302/304 condition A.

3.1.2 Lock-wire sizes

- a. 0.5080 mm (0.020 inch) diameter
- b. 0.8128 mm (0.032 inch) diameter NOV P/N Z6000.8
- c. 1.1938 mm (0.047 inch) diameter NOV P/N Z6000.9
- d. 1.2950 mm (0.051 inch) diameter NOV P/N Z6001
- e. 3.1750 mm (0.125 inch) diameter NOV P/N Z6002

3.2 **GENERAL REQUIREMENTS**

3.2.1 Safety wire shall be new upon each application.

3.2.2 Parts shall be lockwired in such a manner that the lockwire shall be put in tension when the part tends to loosen.

3.2.3 The lockwire should always be installed and twisted so that the loop around the head stays down and does not tend to come up over bolt head and leave a slack loop.

3.2.4 Care shall be exercised when installing lockwire to ensure that it is tight but not over stressed.

3.2.5 Properly twisted lockwire will have 7-12 twists per inch for .032 wire and 6-8 turns for .052 wire. More twists will over stress the wire and cause fatigue and breakage.

3.2.6 A pigtail should be ½" to 5/8" in length (4-8 twists) at the end of the wiring. This pigtail shall be bent back or under to prevent it from becoming a snag.

3.2.7 As per the Machinery's Handbook 27th edition the following rules apply:

- a) No more than three (3) bolts may be tied together.
- b) Bolt heads may be tied as shown only when the female thread receiver is captive.(see figure 1)
- c) Lockwire must fill a minimum of 50% of the drilled hole provided for the use of lockwire.
- d) Diameter of lockwire is determined by the thread size of the fastener to be lockwired.
 - 1) Thread sizes of 6 mm (0.25 inch) and smaller use 0.508mm (0.020 inch) wire.
 - 2) Thread sizes of 6 mm (0.25 inch) to 12 mm (0.5 inch) use 0.8128 mm (0.032 inch) wire.
 - 3) Thread sizes > 12 mm (0.5 inch) use 1.1938 mm (0.047 inch) OR 1.295mm (0.051) wire.

The larger wire may be used in smaller bolts in cases of convenience, but smaller wire must not be used in larger fastener sizes.

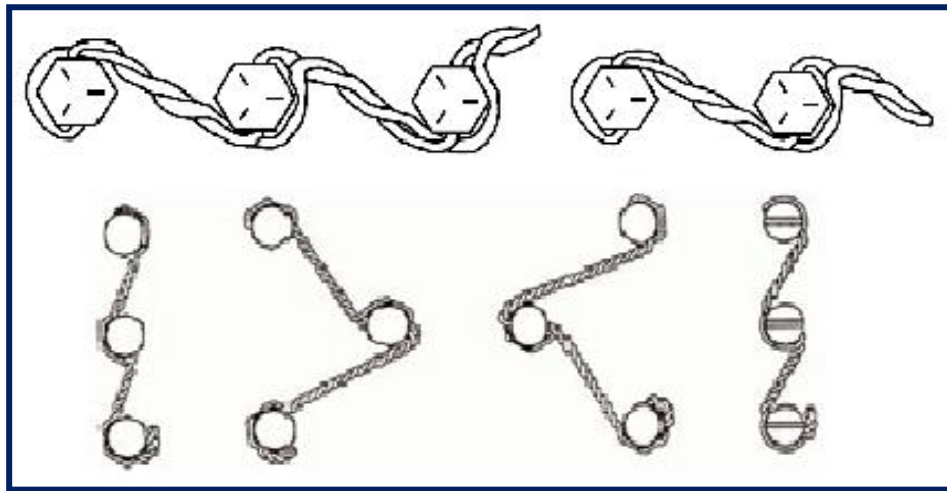


Figure 1: Safety Wire / Lock Wire

3.3 **LOCK-WIRING METHODS**

3.3.1 The method involves threading a wire through holes in the fastener to lock it against being rotated loose. The wire is twisted before being threaded and is locked to next bolt. Safety wire should be placed in and around bolt head to maintain the pre-load. The use of safety wire ties is illustrated in figure 1 above. The illustrations assume the use of right-hand threaded fasteners.

3.3.2 The double-twist method:

The double-twist method of lock-wiring shall be used as the common method of lock-wiring.

CAUTION: screws in closely spaced geometric which secure hydraulic or air seals, hold hydraulic pressure, or used in critical areas of clutch mechanism should use double twist method of lock-wiring. Make sure that the wire is so installed that it can easily be broken when required in an emergency situation.

3.3.3 Lock-wiring widely spaced multiple groups by the double twist method.

- When the multiple fasteners are from 4-6 inches apart, three (3) fasteners shall be the maximum number in a series that can be safety wired together.
- When the multiple fasteners are spaced more than 6 inches apart, the multiple fastener application specified in Figure 1 shall not be used unless tie points are provided on adjacent parts to shorten the span of the wire to less than 6 inches.
- One end of the safety wire shall be inserted through one set of lockwire holes in the head of the bolt. The other end of the safety wire shall be looped around the bolt head in the tightening direction.

- d) The strands, while taut, shall be twisted until the twisted part is just short of the nearest hole in the next bolt. The twisted portion shall be within 1/8" of the holes in each bolt as shown in figure 1 above.
- e) After wiring the last bolt, the wire shall be twisted to form a pigtail of 2-4 twists. The excess wire shall be cut off. The pigtail shall be bent back or under the part to prevent it from becoming a snag.

3.3.4 Single wire method:

The single wire method may be used in a closely spaced, closed geometrical pattern (triangle, square, circle, etc.) on parts in an electrical system, and in places that would make the single-method more advisable as shown in figure 2 below. Closely spaced shall be considered a maximum of two inches between centers. Maximum length of wire shall not exceed 24" in total length.

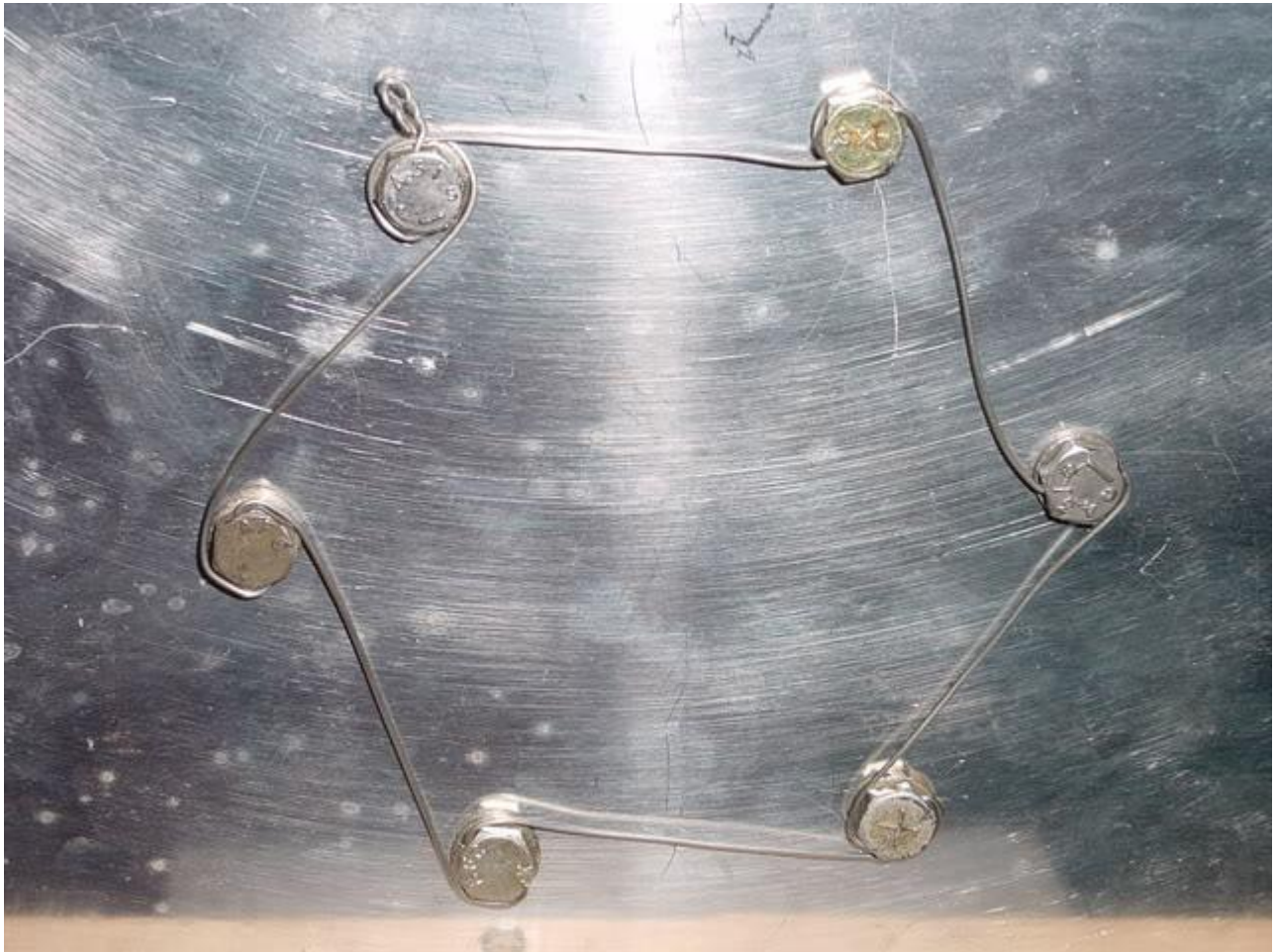


Figure 2: Safety Wire / Lock Wire Single

3.4.1 Hollow head bolts are safety wired in the manner prescribed for regular bolts.

3.4.2 Drain plugs and cocks may be wired to a bolt, nut, or other part having a free lock hole in accordance with the general instructions contained herein.

3.4.3 External snap rings may be locked if necessary in accordance with the general locking principles contained herein.

3.4.4 Internal snap rings shall never be lockwired.

3.4.5 Bolts and hardware may be wired using SAFE-T-Cable. Follow procedure D744000087-PRO-001.

Safe-T-Cable® can be used similar to Safety/Lock wire to secure Fasteners. The safety cable installation procedure is shown in Figure. The safety cable comes in pre-cut lengths with stubs on one end. After sewing through the holes in the fasteners they are tightened and crimped using a ferrule cartridge and crimping tool.

They are more convenient to use and take only a fraction of the time to secure fasteners as compared to safety wire as no wire twisting is required. However additional tools like ferrule cartridge and crimping tool are required. For additional information refer Safe-T-Cable® (website http://www.dmctools.com/Catalog/safe_t_cable.htm).

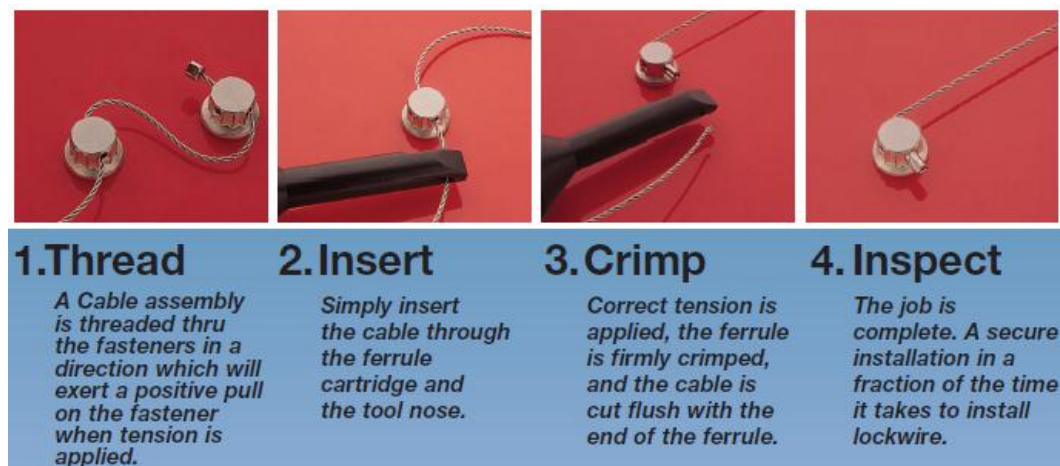
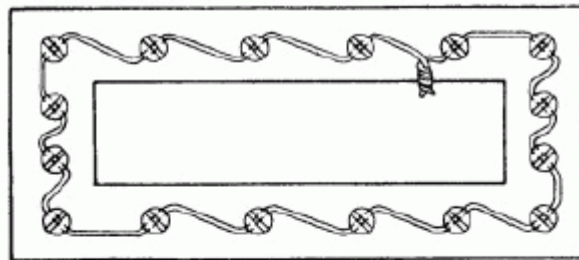
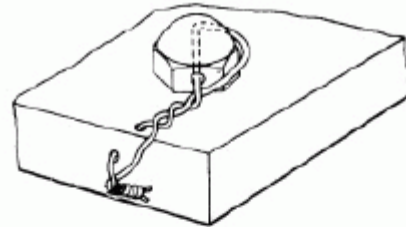


Figure 3: Safety Cable Installation Procedure

3.5 ILLUSTRATION OF TYPICAL LOCK-WIRE APPLICATION



SMALL SCREWS IN CLOSELY
SPACED CLOSED GEOMETRICAL
PATTERN
SINGLE-WIRE METHOD



SINGLE-FASTENER APPLICATION
DOUBLE-TWIST METHOD



SCREWHEADS
DOUBLE-TWIST METHOD



EXTERNAL SNAPPING
SINGLE-WIRE METHOD



BOLT HEADS



CASTLE NUTS

NOTE

THE SAFETYWIRE IS SHOWN INSTALLED FOR RIGHT-HAND THREADS. THE SAFETYWIRE
IS ROUTED IN THE OPPOSITE DIRECTION FOR LEFT-HAND THREADS.

4 QA PROVISIONS

5 NOTES

DS00008

Design Specification

Design Torque Standard

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NATIONAL OILWELL VARCO

TITLE

Design Torque Standard

DRAWN

B. Levay

A. Vargas

CHECKED

N. West

B. Levay

APPVD

T. Montgomery

JB

DATE

2/13/15

11.13.1992

SIZE

A

DWG NO

DS00008

REV

G

SCALE NONE

WT LBS

SHEET 1 OF 16

NOTES

1. Unless noted, all values are based on light machine oil or anti-seize lubricated bolts (not high pressure lubes).
2. NOV does not recommend assembling bolts dry.
3. Proof strength is 92% of minimum yield strength.
4. Torque values given represent 70% and 80% of proof strength.
5. Clamp force is based on 75% of proof strength.
6. These torque values are to be followed unless otherwise specified.
7.  If torqueing into aluminum, contact engineering for appropriate torque value.
8. After torqueing fasteners, identify by marking head. Follow with lockwire per ASP00019 for all drilled head fasteners.
9. Equations used to generate the values in this document:
Clamp Force= (.75)(Proof Strength)(Thread Area)
Torque= (Screw Diameter)(Clamp Force)(k)
k= .0160_{min} / .0176_{max} for light oil or Loctite
k= .0120_{min} / .0132_{max} for anti-seize
10. For fastener grades not listed in the following tables, use the equations in note 9, or use the table that most closely matches the screw's proof strength (see note 3).

SIZE A	DWG NO DS00008	REV G
SCALE NONE	WT LBS	SHEET 2 OF 16

TORQUE VALUES FOR LIGHT MACHINE OIL LUBRICATED BOLTS

GRADE 2

GRADE 5

T.S. = 74,000 PSI to 3/4" DIA

T.S. = 120,000 PSI to 1" DIA

PROOF STRENGTH = 55,000 PSI

PROOF STRENGTH = 85,000 PSI

T.S. = 60,000 PSI 7/8" to 1-1/2" DIA

T.S. = 105,000 PSI 1-1/8" to 1-1/2" DIA

PROOF STRENGTH = 33,000 PSI

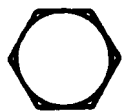
PROOF STRENGTH = 74,000 PSI

COARSE THREAD SERIES - UNC

Dia-Threads Per Inch	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)
1/4 - 20	5.2	5.8	1,312	8.1	8.9	2,027
5/16 - 18	10.8	11.9	2,162	16.7	18.4	3,341
3/8 - 16	19.2	21.1	3,197	30	33	4,941
7/16 - 14	31	34	4,385	47	52	6,777
1/2 - 13	47	52	5,853	72	80	9,046
9/16 - 12	68	74	7,508	104	115	11,603
5/8 - 11	93	103	9,323	144	158	14,408
3/4 - 10	165	182	13,778	256	281	21,293
7/8 - 9	160	176	11,435	412	454	29,453
1 - 8	240	264	14,999	618	680	38,633
1 1/8 - 7	340	374	18,884	762	838	42,347
1 1/4 - 7	480	528	23,983	1,076	1,183	53,780 
1 3/8 - 6	626	689	28,463	1,404	1,545	63,825 
1 1/2 - 6	835	918	34,774	1,871	2,059	77,978 

FINE THREAD SERIES - UNF

1/4 - 28	6.0	6.6	1,502	9.3	10.2	2,321
5/16 - 24	12.0	13.2	2,393	18.5	20.3	3,698
3/8 - 24	21.7	23.9	3,622	34	37	5,597
7/16 - 20	34	38	4,896	53	58	7,567
1/2 - 20	53	58	6,596	82	90	10,194
9/16 - 18	75	83	8,374	116	128	12,941
5/8 - 18	106	116	10,560	163	180	16,320
3/4 - 16	185	203	15,386	285	314	23,779
7/8 - 14	176	194	12,598	454	500	32,449
1 - 14 (UNS)	269	296	16,805	693	762	43,286
1 1/8 - 12	381	419	21,186	855	941	47,508 
1 1/4 - 12	531	584	26,557	1,191	1,310	59,552 
1 3/8 - 12	716	788	32,546	1,606	1,766	72,983 
1 1/2 - 12	939	1,033	39,130	2,106	2,316	87,746 



SIZE A	DWG NO DS00008	REV G
SCALE NONE	WT LBS	SHEET 3 OF 16

TORQUE VALUES FOR LIGHT MACHINE OIL LUBRICATED BOLTS						
	GRADE 8			EXTREME STRENGTH		
	TENSILE STRENGTH = 150,000 PSI			TENSILE STRENGTH = 170,000 PSI		
	PROOF STRENGTH = 120,000 PSI			PROOF STRENGTH = 136,000 PSI		
COARSE THREAD SERIES - UNC						
Dia-Threads Per Inch	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)
1/4 – 20	11.4	12.6	2,862	13.0	14.3	3,244
5/16 – 18	23.6	25.9	4,716	27	29	5,345
3/8 – 16	42	46	6,975	47	52	7,905
7/16 – 14	67	74	9,567	76	83	10,843
1/2 – 13	102	112	12,771	116	127	14,474
9/16 – 12	147	162	16,380	167	184	18,564
5/8 – 11	203	224	20,340	231	254	23,052
3/4 – 10	361	397	30,060	409	450	34,068
7/8 – 9	582	640	41,580	660	726	47,124
1 – 8	873	960	54,540 	989	1,088	61,812 
1 1/8 – 7	1,236	1,360	68,670 	1,401	1,541	77,826 
1 1/4 – 7	1,744	1,919	87,210 	1,977	2,174	98,838 
1 3/8 – 6	2,277	2,505	103,500 	2,581	2,839	117,300 
1 1/2 – 6	3,035	3,338	126,450 	3,439	3,783	143,310 
FINE THREAD SERIES – UNF						
1/4 – 28	13.1	14.4	3,276	14.9	16.3	3,713
5/16 – 24	26	29	5,220	30	33	5,916
3/8 – 24	47	52	7,902	54	59	8,956
7/16 – 20	75	82	10,683	85	93	12,107
1/2 – 20	115	127	14,391	130	144	16,310
9/16 – 18	164	181	18,270	186	205	20,706
5/8 – 18	230	253	23,040	261	287	26,112
3/4 – 16	403	443	33,570	457	502	38,046
7/8 – 14	641	705	45,810 	727	800	51,918 
1 – 14 (UNS)	978	1,076	61,110 	1,108	1,219	69,258 
1 1/8 – 12	1,387	1,525	77,040 	1,572	1,729	87,312 
1 1/4 – 12	1,931	2,125	96,570 	2,189	2,408	109,446 
1 3/8 – 12	2,604	2,864	118,350 	2,951	3,246	134,130 
1 1/2 – 12	3,415	3,756	142,290 	3,870	4,257	161,262 
						
SIZE A		DWG NO DS00008				REV G
SCALE NONE		WT LBS		SHEET 4 OF 16		

TORQUE VALUES FOR LIGHT MACHINE OIL LUBRICATED BOLTS						
	300 SERIES / 18-8 STAINLESS			STAINLESS ASTM F593U		
	TENSILE STRENGTH = 70,000 PSI			TENSILE STRENGTH = 135,000 PSI		
	PROOF STRENGTH = 27,600 PSI			PROOF STRENGTH = 95,000 PSI		
	(YIELD = 30,000 PSI)					
COARSE THREAD SERIES - UNC						
Dia-Threads Per Inch	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)
1/4 – 20	2.6	2.9	658	9.1	10.0	2,266
5/16 – 18	5.4	6.0	1,085	18.7	20.5	3,734
3/8 – 16	9.6	10.6	1,604	33	36	5,522
7/16 – 14	15	17	2,200	53	58	7,574
1/2 – 13	23	26	2,937	81	89	10,110
9/16 – 12	34	37	3,767	117	128	12,968
5/8 – 11	47	51	4,678	161	177	16,103
3/4 – 10	83	91	6,914	286	314	23,798
7/8 – 9	134	147	9,563	461	507	32,918
1 – 8	201	221	12,544	691	760	43,178
1 1/8 – 7	284	313	15,794	979	1,076	54,364 
1 1/4 – 7	401	441	20,058	1,381	1,519	69,041 
1 3/8 – 6	524	576	23,805	1,803	1,983	81,938 
1 1/2 – 6	698	768	29,084	2,403	2,643	100,106 
FINE THREAD SERIES – UNF						
1/4 – 28	3.0	3.3	753	10.4	11.4	2,594
5/16 – 24	6.0	6.6	1,201	20.7	22.7	4,133
3/8 – 24	10.9	12.0	1,817	38	41	6,256
7/16 – 20	17	19	2,457	59	65	8,457
1/2 – 20	26	29	3,310	91	100	11,393
9/16 – 18	38	42	4,202	130	143	14,464
5/8 – 18	53	58	5,299	182	201	18,240
3/4 – 16	93	102	7,721	319	351	26,576
7/8 – 14	148	162	10,536	508	559	36,266
1 – 14 (UNS)	225	247	14,055	774	851	48,379 
1 1/8 – 12	319	351	17,719	1,098	1,208	60,990 
1 1/4 – 12	444	489	22,211	1,529	1,682	76,451 
1 3/8 – 12	599	659	27,221	2,061	2,267	93,694 
1 1/2 – 12	785	864	32,727 	2,704	2,974	112,646 
						
SIZE		DWG NO				REV
A		DS00008				G
SCALE		NONE	WT LBS		SHEET	5 OF 16

TORQUE VALUES FOR BOLTS LUBRICATED WITH AN ANTI-SEIZE COMPOUND

GRADE 2

T.S. = 74,000 PSI to 3/4" DIA

PROOF STRENGTH = 55,000 PSI

T.S. = 60,000 PSI 7/8" to 1-1/2" DIA

PROOF STRENGTH = 33,000 PSI

GRADE 5

T.S. = 120,000 PSI to 1" DIA

PROOF STRENGTH = 85,000 PSI

T.S. = 105,000 PSI 1-1/8" to 1-1/2" DIA

PROOF STRENGTH = 74,000 PSI

COARSE THREAD SERIES - UNC

Dia-Threads Per Inch	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)
1/4 - 20	3.9	4.3	1,312	6.1	6.7	2,027
5/16 - 18	8.1	8.9	2,162	12.5	13.8	3,341
3/8 - 16	14.4	15.8	3,197	22.2	24.5	4,941
7/16 - 14	23.0	25.3	4,385	36	39	6,777
1/2 - 13	35	39	5,853	54	60	9,046
9/16 - 12	51	56	7,508	78	86	11,603
5/8 - 11	70	77	9,323	108	119	14,408
3/4 - 10	124	136	13,778	192	211	21,293
7/8 - 9	120	132	11,435	309	340	29,453
1 - 8	180	198	14,999	464	510	38,633
1 1/8 - 7	255	280	18,884	572	629	42,347
1 1/4 - 7	360	396	23,983	807	887	53,780 
1 3/8 - 6	470	517	28,463	1,053	1,158	63,825 
1 1/2 - 6	626	689	34,774	1,404	1,544	77,978 

FINE THREAD SERIES - UNF

1/4 - 28	4.5	5.0	1,502	7.0	7.7	2,321
5/16 - 24	9.0	9.9	2,393	13.9	15.3	3,698
3/8 - 24	16.3	17.9	3,622	25.2	27.7	5,597
7/16 - 20	26	28	4,896	40	44	7,567
1/2 - 20	40	44	6,596	61	67	10,194
9/16 - 18	57	62	8,374	87	96	12,941
5/8 - 18	79	87	10,560	122	135	16,320
3/4 - 16	138	152	15,386	214	235	23,779
7/8 - 14	132	146	12,598	341	375	32,449
1 - 14 (UNS)	202	222	16,805	519	571	43,286
1 1/8 - 12	286	315	21,186	641	705	47,508 
1 1/4 - 12	398	438	26,557	893	983	59,552 
1 3/8 - 12	537	591	32,546	1,204	1,325	72,983 
1 1/2 - 12	704	775	39,130	1,579	1,737	87,746 



SIZE A	DWG NO DS00008	REV G
SCALE NONE	WT LBS	SHEET 6 OF 16

TORQUE VALUES FOR BOLTS LUBRICATED WITH AN ANTI-SEIZE COMPOUND

GRADE 8

HOLO-KROME

TENSILE STRENGTH = 150,000 PSI

TENSILE STRENGTH = 170,000 PSI

PROOF STRENGTH = 120,000 PSI

PROOF STRENGTH = 136,000 PSI

COARSE THREAD SERIES - UNC

Dia-Threads Per Inch	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)
1/4 – 20	8.6	9.5	2,860	9.7	10.7	3,240
5/16 – 18	17.8	19.7	3,720	20.0	22.0	5,340
3/8 – 16	32	35	7,000	36	39	7,920
7/16 – 14	50	55	9,550	57	63	10,850
1/2 – 13	78	87	12,750	87	96	14,450
9/16 – 12	107	118	16,100	125	138	18,500
5/8 – 11	157	173	20,350	173	190	23,000
3/4 – 10	271	299	30,100	307	337	34,000
7/8 – 9	428	473	41,600	495	544	47,000 
1 – 8	641	709	54,500 	742	816	61,700 
1 1/8 – 7	912	1,008	68,700 	1,051	1,156	77,800 
1 1/4 – 7	1,297	1,433	87,200 	1,483	1,631	98,700 
1 3/8 – 6	1,696	1,874	104,000 	1,935	2,129	117,800 
1 1/2 – 6	2,252	2,489	126,500 	2,580	2,838	143,200 

FINE THREAD SERIES – UNF

1/4 – 28	10	11	3,280	11.1	12.3	3,713
5/16 – 24	17.8	19.7	5,220	22.2	24.4	5,916
3/8 – 24	36	39	7,900	40	44	8,956
7/16 – 20	57	63	10,700	64	70	12,107
1/2 – 20	86	95	14,400	98	108	16,310
9/16 – 18	121	134	18,250	140	154	20,706
5/8 – 18	171	189	23,000	196	215	26,112
3/4 – 16	299	331	33,600	342	377	38,046
7/8 – 14	470	520	45,800 	545	600	51,918 
1 – 14 (UNS)	713	788	59,700 	831	914	69,258 
1 1/8 – 12	1,026	1,134	77,000 	1,179	1,297	87,312 
1 1/4 – 12	1,425	1,575	96,600 	1,642	1,806	109,446 
1 3/8 – 12	1,938	2,142	11,840 	2,213	2,434	134,130 
1 1/2 – 12	2,537	2,804	142,200 	2,903	3,193	161,262 



SIZE A	DWG NO DS00008	REV G
SCALE NONE	WT LBS	SHEET 7 OF 16

TORQUE VALUES FOR BOLTS LUBRICATED WITH AN ANTI-SEIZE COMPOUND												
	300 SERIES / 18-8 STAINLESS			STAINLESS ASTM F593U								
	TENSILE STRENGTH = 70,000 PSI			TENSILE STRENGTH = 135,000 PSI								
	PROOF STRENGTH = 27,600 PSI			PROOF STRENGTH = 95,000 PSI								
	(YIELD = 30,000 PSI)											
COARSE THREAD SERIES - UNC												
Dia-Threads Per Inch	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)						
1/4 – 20	10.5	11.6	658	6.8	7.5	2,266						
5/16 – 18	17.4	19.1	1,085	14.0	15.4	3,734						
3/8 – 16	25.7	28.2	1,604	24.8	27.3	5,522						
7/16 – 14	35	39	2,200	40	44	7,574						
1/2 – 13	47	52	2,937	61	67	10,110						
9/16 – 12	60	66	3,767	88	96	12,968						
5/8 – 11	75	82	4,678	121	133	16,103						
3/4 – 10	111	122	6,914	214	236	23,798						
7/8 – 9	153	168	9,563	346	380	32,918						
1 – 8	201	221	12,544	518	570	43,178						
1 1/8 – 7	253	278	15,794	734	807	54,364 						
1 1/4 – 7	321	353	20,058	1,036	1,139	69,041 						
1 3/8 – 6	381	419	23,805	1,352	1,487	81,938 						
1 1/2 – 6	465	512	29,084	1,802	1,982	100,106 						
FINE THREAD SERIES – UNF												
1/4 – 28	12.1	13.3	753	7.8	8.7	2,594						
5/16 – 24	19.2	21.1	1,201	15.7	17.3	4,133						
3/8 – 24	29.1	32.0	1,817	28	31	6,256						
7/16 – 20	39	43	2,457	44	49	8,457						
1/2 – 20	53	58	3,310	68	75	11,393						
9/16 – 18	67	74	4,202	97	107	14,464						
5/8 – 18	85	93	5,299	135	150	18,240						
3/4 – 16	124	136	7,721	237	261	26,576						
7/8 – 14	169	185	10,536	377	417	36,266						
1 – 14 (UNS)	225	247	14,055	561	620	48,379 						
1 1/8 – 12	284	312	17,719	815	901	60,990 						
1 1/4 – 12	355	391	22,211	1,135	1,254	76,451 						
1 3/8 – 12	436	479	27,221	1,530	1,691	93,694 						
1 1/2 – 12	524	576	32,727 	2,006	2,218	112,646 						
F593 U												
				<table><tr><td>SIZE</td><td>DWG NO</td><td>REV</td></tr><tr><td>A</td><td>DS00008</td><td>G</td></tr></table>		SIZE	DWG NO	REV	A	DS00008	G	
SIZE	DWG NO	REV										
A	DS00008	G										
SCALE NONE				WT LBS	SHEET 8 OF 16							

TORQUE VALUES FOR LIGHT MACHINE OIL LUBRICATED BOLTS

CLASS 4.6

T.S. = 400 MPa

PROOF STRENGTH = 225 MPa

T.S. is for all dia.

CLASS 8.8

T.S. = 830 MPa

PROOF STRENGTH = 600 MPa

T.S. is for all dia

Metric socket head screws

METRIC SERIES

Diameter - pitch	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)
M3 - .5	0.4	0.4	191	1.0	1.1	509
M3.5 - .6	0.6	0.6	257	1.5	1.7	686
M4 - .7	0.8	0.9	333	2.2	2.5	888
M5 - .8	1.7	1.9	539	4.5	5.0	1,437
M6 - 1	2.9	3.2	763	7.7	8.5	2,033
M8 - 1.25	7.0	7.7	1,388	18.7	20.5	3,703
M10 - 1.5	13.9	15.2	2,200	37	41	5,868
M12 - 1.75	24.2	26.6	3,198	64	71	8,528
M14 - 2	38	42	4,363	103	113	11,634
M16 - 2	60	66	5,956	160	176	15,883
M18 - 2.5	83	91	7,284	220	242	19,423
M20 - 2.5	117	129	9,294	312	343	24,785
M22 - 2.5	159	175	11,495	425	467	30,653
M24 - 3	202	223	13,392	540	594	35,711
M27 - 3	296	326	17,413	790	869	46,434
M30 - 3.5	402	442	21,282	1,072	1,180	56,753 
M33 - 3.5	547	602	26,328	1,459	1,605	70,208 
M36 - 3.5	703	773	30,994	1,874	2,062	82,651 
M39 - 4	910	1,001	37,026	2,426	2,668	98,736 
M42 - 4.5	1,124	1,237	42,489	2,998	3,297	113,304 
M48 - 5	1,678	1,846	55,510 	4,475	4,923	148,003 
M56 - 5.5	2,663	2,929	75,494 	7,102	7,812	201,316 



SIZE A	DWG NO DS00008	REV G
SCALE NONE	WT LBS	SHEET 9 OF 16

TORQUE VALUES FOR LIGHT MACHINE OIL LUBRICATED BOLTS

CLASS 10.9

T.S. = 1040 MPa

PROOF STRENGTH = 830 MPa

T.S. is for all dia

CLASS 12.9

T.S. = 1220 MPa

PROOF STRENGTH = 970 MPa

T.S. is for all dia.

* Metric socket head screws*

Diameter - pitch	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)
M3 - .5	1.3	1.5	704	1.6	1.7	823
M3.5 - .6	2.1	2.3	949	2.4	2.7	1,109
M4 - .7	3.1	3.4	1,229	3.6	4.0	1,436
M5 - .8	6.3	6.9	1,987	7.3	8.0	2,322
M6 - 1	10.6	11.7	2,813	12.4	13.7	3,287
M8 - 1.25	26	28	5,122	30	33	5,986
M10 - 1.5	51	56	8,117	60	66	9,486
M12 - 1.75	89	98	11,797	104	115	13,787
M14 - 2	142	156	16,094	166	182	18,808
M16 - 2	221	244	21,971	259	285	25,677
M18 - 2.5	305	335	26,869	356	392	31,401
M20 - 2.5	432	475	34,286	505	555	40,069
M22 - 2.5	588	646	42,403	687	755	49,555 
M24 - 3	747	822	49,400 	873	960	57,733 
M27 - 3	1,092	1,202	64,234 	1,277	1,404	75,069 
M30 - 3.5	1,484	1,632	78,508 	1,734	1,907	91,751 
M33 - 3.5	2,019	2,221	97,121 	2,359	2,595	113,503 
M36 - 4	2,593	2,852	114,334 	3,030	3,333	133,619 
M39 - 4	3,355	3,691	136,585 	3,921	4,314	159,623 
M42 - 4.5	4,147	4,561	156,737 	4,846	5,331	183,174 
M48 - 5	6,190	6,810	204,737 	7,235	7,958	239,271 
M56 - 5.5	9,824	10,806	278,488 	11,481	12,629	325,461 



SIZE A	DWG NO DS00008	REV G
SCALE NONE	WT LBS	SHEET 10 OF 16

TORQUE VALUES FOR BOLTS WITH AN ANTI-SEIZE COMPOUND

CLASS 4.6

T.S. = 400 MPa

PROOF STRENGTH = 225 MPa

T.S. is for all dia.

CLASS 8.8

T.S. = 830 MPa

PROOF STRENGTH = 600 MPa

T.S. is for all dia

Metric socket head screws

METRIC SERIES

Diameter - pitch	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)
M3 - .5	0.3	0.3	191	0.7	0.8	509
M3.5 - .6	0.4	0.5	257	1.1	1.2	686
M4 - .7	0.6	0.7	333	1.7	1.8	888
M5 - .8	1.3	1.4	539	3.4	3.7	1,437
M6 - 1	2.2	2.4	763	5.8	6.3	2,033
M8 - 1.25	5.2	5.8	1,388	14.0	15.4	3,703
M10 - 1.5	10.4	11.4	2,200	28	30	5,868
M12 - 1.75	18.1	19.9	3,198	48	53	8,528
M14 - 2	29	32	4,363	77	85	11,634
M16 - 2	45	50	5,956	120	132	15,883
M18 - 2.5	62	68	7,284	165	182	19,423
M20 - 2.5	88	97	9,294	234	258	24,785
M22 - 2.5	119	131	11,495	319	350	30,653
M24 - 3	152	167	13,392	405	445	35,711
M27 - 3	222	244	17,413	592	652	46,434
M30 - 3.5	302	332	21,282	804	885	56,753 
M33 - 3.5	410	452	26,328	1,095	1,204	70,208 
M36 - 3.5	527	580	30,994	1,406	1,546	82,651 
M39 - 4	682	750	37,026	1,819	2,001	98,736 
M42 - 4.5	843	927	42,489	2,248	2,473	113,304 
M48 - 5	1,259	1,384	55,510 	3,356	3,692	148,003 
M56 - 5.5	1,997	2,197	75,494 	5,326	5,859	201,316 



SIZE A	DWG NO DS00008	REV G
SCALE NONE	WT LBS	SHEET 11 OF 16

TORQUE VALUES FOR BOLTS WITH AN ANTI-SEIZE COMPOUND						
	CLASS 10.9			CLASS 12.9		
	T.S. = 1040 MPa			T.S. = 1220 MPa		
	PROOF STRENGTH = 830 MPa			PROOF STRENGTH = 970 MPa		
	T.S. is for all dia			T.S. is for all dia.		
				* Metric socket head screws*		
Diameter - pitch	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)	Min. Torque (ft-lbf)	Max. Torque (ft-lbf)	Clamp Force (lb)
M3 - .5	1.0	1.1	704	1.2	1.3	823
M3.5 - .6	1.6	1.7	949	1.8	2.0	1,109
M4 - .7	2.3	2.6	1,229	2.7	3.0	1,436
M5 - .8	4.7	5.2	1,987	5.5	6.0	2,322
M6 - 1	8.0	8.8	2,813	9.3	10.3	3,287
M8 - 1.25	19.4	21.3	5,122	22.6	24.9	5,986
M10 - 1.5	38	42	8,117	45	49	9,486
M12 - 1.75	67	74	11,797	78	86	13,787
M14 - 2	106	117	16,094	124	137	18,808
M16 - 2	166	183	21,971	194	214	25,677
M18 – 2.5	228	251	26,869	267	294	31,401
M20 – 2.5	324	356	34,286	379	416	40,069
M22 – 2.5	441	485	42,403	515	567	49,555 
M24 – 3	560	616	49,400 	655	720	57,733 
M27 – 3	819	901	64,234 	958	1,053	75,069 
M30 - 3.5	1,113	1,224	78,508 	1,300	1,430	91,751 
M33 – 3.5	1,514	1,666	97,121 	1,770	1,947	113,503 
M36 – 4	1,945	2,139	114,334 	2,273	2,500	133,619 
M39 – 4	2,517	2,768	136,585 	2,941	3,235	159,623 
M42 - 4.5	3,110	3,421	156,737 	3,635	3,998	183,174 
M48 - 5	4,643	5,107	204,737 	5,426	5,969	239,271 
M56 – 5.5	7,368	8,105	278,488 	8,611	9,472	325,461 



The following tables specify torque values for fasteners used with Nord-Lock washers.

SIZE A	DWG NO DS00008	REV G
SCALE NONE	WT LBS	SHEET 12 OF 16

NORD-LOCK "Delta Protekt" Washers with Zinc Plated Bolt 8.8						
Washer Size	Bolt Size	Pitch (mm)	Oil		Graphite	
			Torque (ft-lbf)	Clamp (lb)	Torque (ft-lbf)	Clamp (lb)
NL3	M3	.5	1.2	540	1.2	540
NL4	M4	.7	3.0	944	2.7	944
NL5	M5	.8	5.8	1,529	5.2	1,529
NL6	M6	1.0	10	2,181	9.1	2,181
NL8	M8	1.25	24	4,047	22	4,047
NL10	M10	1.5	47	6,295	43	6,295
NL12	M12	1.75	82	8,992	74	8,992
NL14	M14	2.0	129	12,364	117	12,364
NL16	M16	2.0	197	16,861	177	16,861
NL18	M18	2.5	276	20,682	249	20,682
NL20	M20	2.5	385	26,527	348	26,527
NL22	M22	2.5	525	32,822	474	32,822
NL24	M24	3.0	664	37,993	599	37,993
NL27	M27	3.0	968	49,683	873	49,683
NL30	M30	3.5	1,322	60,474	1,192	60,474
NL33	M33	3.5	1,779	74,861	1,600	74,861
NL36	M36	4.0	2,295	88,125	2,067	88,125
NL39	M39	4.0	2,960	105,211	2,663	105,211
NL42	M42	4.5	3,663	120,947	3,297	120,947

NORD-LOCK "Delta Protekt" Washers with Zinc Plated Bolt 10.9						
Washer Size	Bolt Size	Pitch (mm)	Oil		Graphite	
			Torque (ft-lbf)	Clamp (lb)	Torque (ft-lbf)	Clamp (lb)
NL3	M3	.5	1.7	719	1.5	764
NL4	M4	.7	3.9	1,259	3.5	1,326
NL5	M5	.8	7.8	2,046	6.7	2,158
NL6	M6	1.0	14	2,900	12	3,057
NL8	M8	1.25	33	5,171	29	5,620
NL10	M10	1.5	64	8,318	56	8,768
NL12	M12	1.75	110	12,140	95	12,814
NL14	M14	2.0	175	16,636	151	17,535
NL16	M16	2.0	268	22,481	230	23,830
NL18	M18	2.5	375	27,651	323	29,225
NL20	M20	2.5	524	35,070	451	37,093
NL22	M22	2.5	714	43,613	613	46,086
NL24	M24	3.0	903	50,582	776	53,505
NL27	M27	3.0	1,318	66,094	1,128	69,691
NL30	M30	3.5	1,798	80,482	1,542	84,978
NL33	M33	3.5	2,422	99,590	2,068	105,211
NL36	M36	4.0	3,125	117,350	2,673	123,870
NL39	M39	4.0	4,030	140,281	3,440	148,149
NL42	M42	4.5	4,988	160,963	4,262	170,180

SIZE A	DWG NO DS00008	REV G
SCALE NONE	WT LBS	SHEET 13 OF 16

NORD-LOCK "Delta Protekt" Washers with Zinc Plated Bolt 12.9						
			Oil		Graphite	
Washer Size	Bolt Size	Pitch (mm)	Torque (ft-lbf)	Clamp (lb)	Torque (ft-lbf)	Clamp (lb)
NL3	M3	.5	1.9	877	1.6	922
NL4	M4	.7	4.4	1,506	3.8	1,596
NL5	M5	.8	8.7	2,450	7.4	2,585
NL6	M6	1.0	15	3,462	13	3,664
NL8	M8	1.25	36	6,295	31	6,744
NL10	M10	1.5	72	9,892	61	10,566
NL12	M12	1.75	123	14,613	105	15,287
NL14	M14	2.0	196	20,008	167	21,132
NL16	M16	2.0	298	26,977	252	28,551
NL18	M18	2.5	419	33,272	355	35,070
NL20	M20	2.5	585	42,264	494	44,512
NL22	M22	2.5	797	52,380	670	55,303
NL24	M24	3.0	1,009	60,698	850	64,295
NL27	M27	3.0	1,470	79,133	1,235	83,629
NL30	M30	3.5	2,005	96,668	1,688	102,063
NL33	M33	3.5	2,699	119,598	2,265	126,343
NL36	M36	4.0	3,483	140,730	2,927	148,823
NL39	M39	4.0	4,490	168,157	3,763	177,599
NL42	M42	4.5	5,560	193,336	4,666	204,126

NORD-LOCK Stainless Steel with Stainless Steel Bolt A4						
			A4-70 w/ Graphite Lube		A4-80 w/ Graphite Lube	
Washer Size	Bolt Size	Pitch (mm)	Torque (ft-lbf)	Clamp (lb)	Torque (ft-lbf)	Clamp (lb)
NL3	M3	.5	0.9	337	1.2	450
NL4	M4	.7	1.9	585	2.6	764
NL5	M5	.8	3.7	922	5.1	1,236
NL6	M6	1.0	7	1,326	9	1,754
NL8	M8	1.25	16	2,473	21	3,147
NL10	M10	1.5	32	3,822	41	5,171
NL12	M12	1.75	54	5,620	72	7,419
NL14	M14	2.0	85	7,644	114	10,116
NL16	M16	2.0	130	10,341	174	13,713
NL18	M18	2.5	183	12,589	244	16,861
NL20	M20	2.5	256	16,186	341	21,357
NL22	M22	2.5	349	20,008	465	26,527
NL24	M24	3.0	441	23,155	588	30,799
NL27	M27	3.0	643	30,124	858	40,241
NL30	M30	3.5	877	36,869	1,170	49,233
NL33	M33	3.5	1,182	45,636	1,576	60,698
NL36	M36	4.0	1,525	53,729	2,034	71,714
NL39	M39	4.0	1,968	64,071	2,624	85,652
NL42	M42	4.5	2,435	73,737	3,247	98,241

SIZE A	DWG NO DS00008	REV G
SCALE NONE	WT LBS	SHEET 14 OF 16

NORD-LOCK "Delta Protekt" Washers with Zinc Plated Bolt Grade 5						
			Oil		Graphite	
Washer Size	Bolt Size	Pitch (TPI)	Torque (ft-lbf)	Clamp (lb)	Torque (ft-lbf)	Clamp (lb)
NL3	#5	40	1.1	550	1.0	550
NL3.5	#6	32	1.4	630	1.3	630
NL4	#8	32	2.7	970	2.4	970
NL5	#10	24	3.9	1,200	3.5	1,200
NL1/4"	1/4	20	9.1	2,200	8.3	2,200
NL8	5/16	18	18	3,600	16	3,600
NL3/8"	3/8	16	30	5,400	28	5,400
NL11	7/16	14	47	7,300	42	7,300
NL1/2"	1/2	13	73	9,800	66	9,800
NL14	9/16	12	104	12,600	94	12,600
NL16	5/8	11	145	15,600	131	15,600
NL3/4"	3/4	10	254	23,100	230	23,100
NL22	7/8	9	408	31,900	369	31,900
NL 1"	1	8	617	41,800	557	41,800
NL30	1 1/8	7	771	46,400	697	46,400
NL33	1 1/4	7	1075	58,900	969	58,900
NL36	1 3/8	6	1410	70,200	1,270	70,200
NL39	1 1/2	6	1860	85,500	1,670	85,500

NORD-LOCK "Delta Protekt" Washers with Zinc Plated Bolt Grade 8						
			Oil		Graphite	
Washer Size	Bolt Size	Pitch (TPI)	Torque (ft-lbf)	Clamp (lb)	Torque (ft-lbf)	Clamp (lb)
NL3	#5	40	1.5	740	1.3	780
NL3.5	#6	32	1.9	840	1.7	890
NL4	#8	32	3.5	1,300	3.1	1,400
NL5	#10	24	5.1	1,600	4.6	1,700
NL1/4"	1/4	20	12	2,900	11	3,100
NL8	5/16	18	24	4,900	21	5,100
NL3/8"	3/8	16	41	7,200	36	7,600
NL11	7/16	14	64	9,800	56	10,400
NL1/2"	1/2	13	99	13,100	86	13,900
NL14	9/16	12	138	16,800	122	17,800
NL16	5/8	11	197	20,900	171	22,100
NL3/4"	3/4	10	346	30,900	299	32,700
NL22	7/8	9	556	42,700	479	45,100
NL 1"	1	8	840	56,000	724	59,200
NL30	1 1/8	7	1,190	70,600	1,030	74,500
NL33	1 1/4	7	1,660	89,600	1,430	94,600
NL36	1 3/8	6	2,180	107,000	1,880	113,000
NL39	1 1/2	6	2,870	130,000	2,470	137,000

SIZE	DWG NO			REV
A	DS00008			G
SCALE	NONE	WT LBS	SHEET	15 OF 16

NORD-LOCK Stainless Steel with ASTM A574 Bolt						
			Oil		Graphite	
Washer Size	Bolt Size	Pitch (TPI)	Torque (ft-lbf)	Clamp (lb)	Torque (ft-lbf)	Clamp (lb)
NL3	#5	40	1.7	870	1.6	910
NL3.5	#6	32	2.2	990	2.0	1,050
NL4	#8	32	3.8	1,500	3.7	1,600
NL5	#10	24	5.8	1,900	5.5	2,000
NL1/4"	1/4	20	13	3,400	12	3,700
NL8	5/16	18	26	5,700	23	6,000
NL3/8"	3/8	16	45	8,400	39	8,900
NL11	7/16	14	70	11,500	60	12,200
NL1/2"	1/2	13	109	15,400	93	16,300
NL14	9/16	12	148	19,800	141	20,900
NL16	5/8	11	216	24,600	184	26,000
NL3/4"	3/4	10	378	36,400	321	38,400
NL22	7/8	9	607	50,200	514	53,000
NL 1"	1	8	916	65,900	776	69,600
NL30	1 1/8	7	1,300	83,000	1100	87,700
NL33	1 1/4	7	1,810	105,000	1530	111,000
NL36	1 3/8	6	2,380	126,000	2020	133,000
NL39	1 1/2	6	3,140	153,000	2640	161,000

NORD-LOCK Stainless Steel with ASTM F593 Bolt						
			Oil		Graphite	
Washer Size	Bolt Size	Pitch (TPI)	Torque (ftlb)	Clamp (lb)	Torque (ftlb)	Clamp (lb)
NL3	#5	40	-	-	-	-
NL3.5	#6	32	-	-	-	-
NL4	#8	32	-	-	-	-
NL5	#10	24	-	-	-	-
NL1/4"	1/4	20	5.2	1,300	5.2	1,300
NL8	5/16	18	10.3	2,200	10.3	2,200
NL3/8"	3/8	16	18	3,300	18	3,300
NL11	7/16	14	28	4,500	28	4,500
NL1/2"	1/2	13	43	6,000	43	6,000
NL14	9/16	12	61	7,700	61	7,700
NL16	5/8	11	85	9,500	85	9,500
NL3/4"	3/4	10	104	9,800	104	9,800
NL22	7/8	9	166	13,500	166	13,500
NL 1"	1	8	251	17,700	251	17,700
NL30	1 1/8	7	356	22,300	356	22,300
NL33	1 1/4	7	497	28,300	497	28,300
NL36	1 3/8	6	653	33,800	653	33,800
NL39	1 1/2	6	859	41,100	859	41,100

SIZE	DWG NO			REV
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SCALE	NONE	WT LBS	SHEET	16 OF 16

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Vol.	Chapter/ Section	Title	Document Number	Rev.
1	2.2	Spare Parts List		
		Mechanical Spares Kit Foxhole Slip Assembly	30175005	A

KIT, SPARES, FOXHOLE SLIP ASSEMBLY

Mechanical Spares Kit Foxhole Slip Assembly

NOTES

1. RECOMMENDED COMMISSIONING SPARES, 30175005-1
RECOMMENDED OPERATIONAL SPARES, 30175005-2
RECOMMENDED INSURANCE SPARES, 30175005-3
2. INSURANCE SPARES ARE THOSE PARTS THAT MAY NOT BE STOCKED AND HAVE LONG DELIVERY LEAD TIMES

REFERENCE	REFERENCE DESCRIPTION	
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DOCUMENT NUMBER		REV
30175005		A



REVISION HISTORY

A	3/25/10	SEE EN	Laura Rondou	T Montgomery	T Montgomery
-	7/16/04	First Release	T Montgomery	D Yenzer	D Yenzer
Rev	Date (dd.mm.yyyy)	Reason for issue	Prepared	Checked	Approved

CHANGE DESCRIPTION

Revision	Change Description
-	Initial Release
A	Title Change

Item	Part Number	Description	-1 Recommended Commission Spares	-2 Recommended Operational Spares	-3 Recommended Insurance Spares	Where Used	Description Where Used
Mechanical Components							
1	11883	Filter-Regulator		1		96403-6	Control Plate Assy.
2	11883-3	Gauge, Pressure, Pneumatic	1	1		96403-6	Control Plate Assy.
3	88549	Regulator			1	96403-6	Control Plate Assy.
4	105955-800-B	Valve, Check	1	1		96403-6	Control Plate Assy.
5	56408-24-C	Pin, Clevis	2	6		128027	Foxhole Slip Assy
6	120963	Rod, Leveling Beam			1	128027	Foxhole Slip Assy
7	121157	Seal, Spring Loaded		3		128027	Foxhole Slip Assy
8	141641	Pin, Hanger Bracket	2	6		128027	Foxhole Slip Assy
9	30121461	Pin , Retainer	2	6		128027	Foxhole Slip Assy
<i>Note: Items 10 thru 16 are sufficient to re-build one slip hanger assembly.</i>							
10	120966	Pin, Hanger			4	128027	Foxhole Slip Assy
11	51435-12	Pin, Cotter			4	128027	Foxhole Slip Assy
12	120962	Slip Hanger			2	128027	Foxhole Slip Assy
13	121457	Spring, Extension			2	128027	Foxhole Slip Assy
14	121524	Bushing, Flanged			8	128027	Foxhole Slip Assy
15	120967	Bracket, Slip Hanger			1	128027	Foxhole Slip Assy
16	128035	Bracket, Slip			1	128027	Foxhole Slip Assy
17	120964	Cylinder, Pneumatic			1	120960	Foxhole Slip Assy
18	114382-NG13	Seal Kit, Gland		3		120964	Foxhole Slip Assy
19	114382-NP32	Seal Kit, Piston		3		120964	Foxhole Slip Assy
20	114382-NR13	Seal Kit, Rod		3		120964	Foxhole Slip Assy
21	118844-32-32	Bushing, Fiberglide, 2.00 ID x 2.00		6		120964	Foxhole Slip Assy

Item	Part Number	Description	-1 Recommended Commission Spares	-2 Recommended Operational Spares	-3 Recommended Insurance Spares	Where Used	Description Where Used
22	2630	Button, Circular	12	72		128028	Slip Assemblies
23	128030	Slip Body, 9-5/8 to 14			1	128028	Slip Assemblies
24	128031	Slip Body, 5 to 9-3/4			1	128028	Slip Assemblies
25	30156173	Slip Body, 2-3/8 to 6-5/8			1	128028	Slip Assemblies

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1	3	Technical Documents & Drawings
1	3.1	General/Mechanical Drawings
1	3.2	System/Process Diagrams
1	3.3	Electrical/Instrument <i>Remarks: Section Not Applicable</i>
1	3.4	Performance Data <i>Remarks: Section Not Applicable</i>

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Vol.	Chapter/ Section	Title	Document Number	Rev.
1	3.1	General/Mechanical Drawings		
		Customer Configuration	11455105-GEN	01
		General Arrangement Foxhole Spider	30170902	H
		Kit, Installation, Foxhole Spider Assembly	121765	M.02
		Foxhole Slip Assembly, 3-1/2" to 14" Pipe	120960	R
		Assembly, Elec. Cont. Vlv, PS-16 Plate Assembly, Control Valve	96403	AB
		Filter/Regulator	11883	F
		Slip and Hanger Assembly	121654	E

REVISIONS					
REV	DESCRIPTION	PREPARED / DATE		CHECKED/ DATE	
01	Initial Release	V. Liuzzi	9/18/15	T. Montgomery	9/18/15

STANDARD ORDER INFORMATION

SHIPMENT DATE: May 15, 2016
 PRE-SHIP: None
 RIG TYPE: Jackup
 INSTALLATION LOCATION: United Arab Emirates
 OPERATION LOCATION:
 RELATED CONFIGS: 11455103-GEN (PRS)
 11455106-GEN (Fingerboard)
 SALES ORDER #: 260719
 PURCHASE ORDER #: N/A
 QUOTE # & REV: 213479 Rev 3
 SPARES QUOTE #: TBD
 UNIT #: TBD
 SERIAL #: TBD
 ITEM ID #: TBD

QUALITY REQUIREMENTS

CERTIFICATION: ABS MODU
 DATA BOOK: Standard
 QUALITY PLAN: 11455105-PLN

CONTACT NOTES

PROJECT MANAGER:
 SYSTEM INTEGRATION:
 CONTRACT ADMINISTRATOR: Joyce Guilford
 RESPONSIBLE ENGINEER: Tim Montgomery
 ELECTRICAL ENGINEER:
 SOFTWARE ENGINEER:
 APPLICATION ENGINEER:

APPLICATION NOTES:

	CUSTOMER CONFIGURATION	Sheet 1 of 3	REVISION	Customer:	Lamprell
		DOCUMENT NUMBER	01	Rig:	NDC Rig 9
		11455105-GEN		Equipment:	FSA

PART NUMBER	REFERENCE	QTY			DESCRIPTION
		S/O	-001	-002	

FOXHOLE SLIP ASSEMBLY SYSTEM					
11455105-001		1			Foxhole Slip Assembly System
121765-502	10016220-003		1		Installation Kit, 14" Foxhole Slip Assembly
120960-2-S				REF	Assembly, Foxhole Slip
96403-6				REF	Control Plate Assembly, Foxhole Slip
121654-2	10016213-001		6		Slip and Hanger Assembly, 9-5/8" to 14"
121654-3	10016213-002		6		Slip and Hanger Assembly, 3-1/2" to 8-1/4"
2630	10113309-001		36		Button, Casing/Collar
REFERENCE DRAWINGS					
					<i>General Arrangement Drawing</i>
30170902				REF	General Arrangement Drawing, Foxhole Slip Assembly
					<i>Mechanical Drawings</i>
3PS00063				REF	Functional Design Description, Foxhole Slip Assembly
112499				REF	Pneumatic Schematic, Foxhole Slip Assembly
30175005				REF	Mechanical Spares List, Foxhole Slip Assembly

	CUSTOMER CONFIGURATION	Sheet 2 of 3 DOCUMENT NUMBER 11455105-GEN	REVISION 01	Customer:	Lamprell NDC Rig 9 FSA
				Rig: Equipment:	

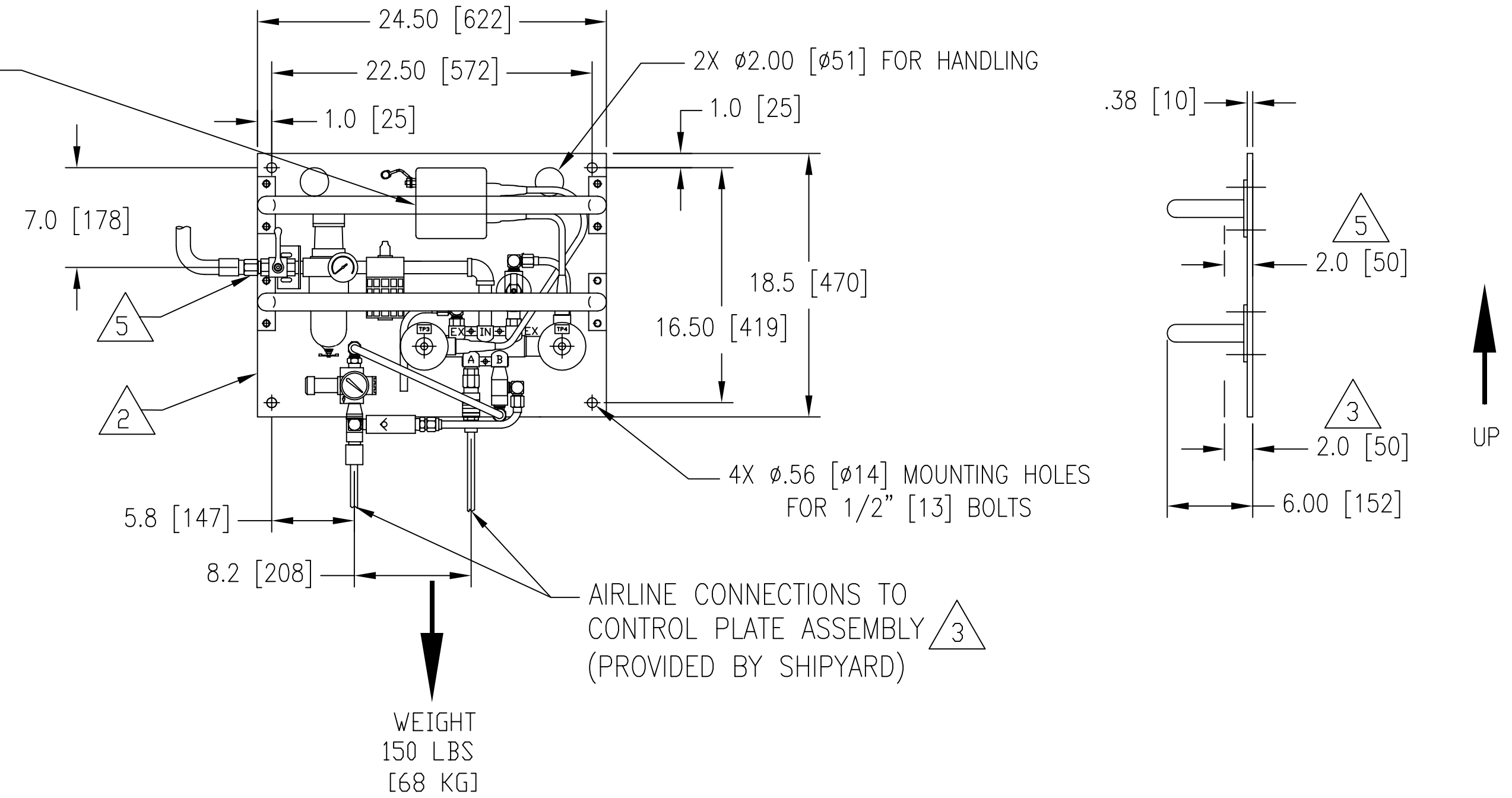
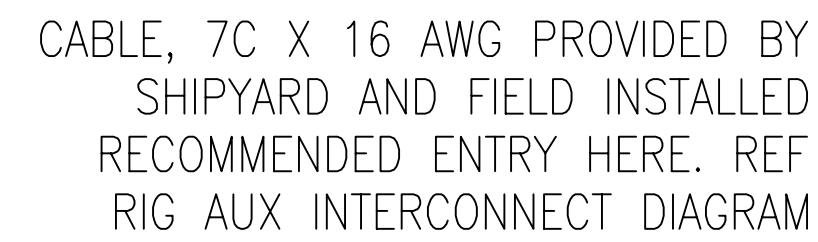
PART NUMBER	REFERENCE	QTY			DESCRIPTION
		S/O	-001	-002	

MANUALS, CERTIFICATION, AND DOCUMENTATION					
16522969-001		2			User Manual, Foxhole Slip Assembly (2 CD Copies Included)
11455105-998		2			Data Book, Standard (2 CD Copies Included)
TS00331				REF	Factory Acceptance Test, Foxhole Slip Assembly
3FIP00240				REF	Installation Procedure, Foxhole Slip Assembly
FIP00058				REF	Commissioning Procedure, Foxhole Slip Assembly

	CUSTOMER CONFIGURATION	Sheet 3 of 3 DOCUMENT NUMBER 11455105-GEN	REVISION 01	<i>Customer:</i>	Lamprell
				<i>Rig:</i>	NDC Rig 9
				<i>Equipment:</i>	FSA

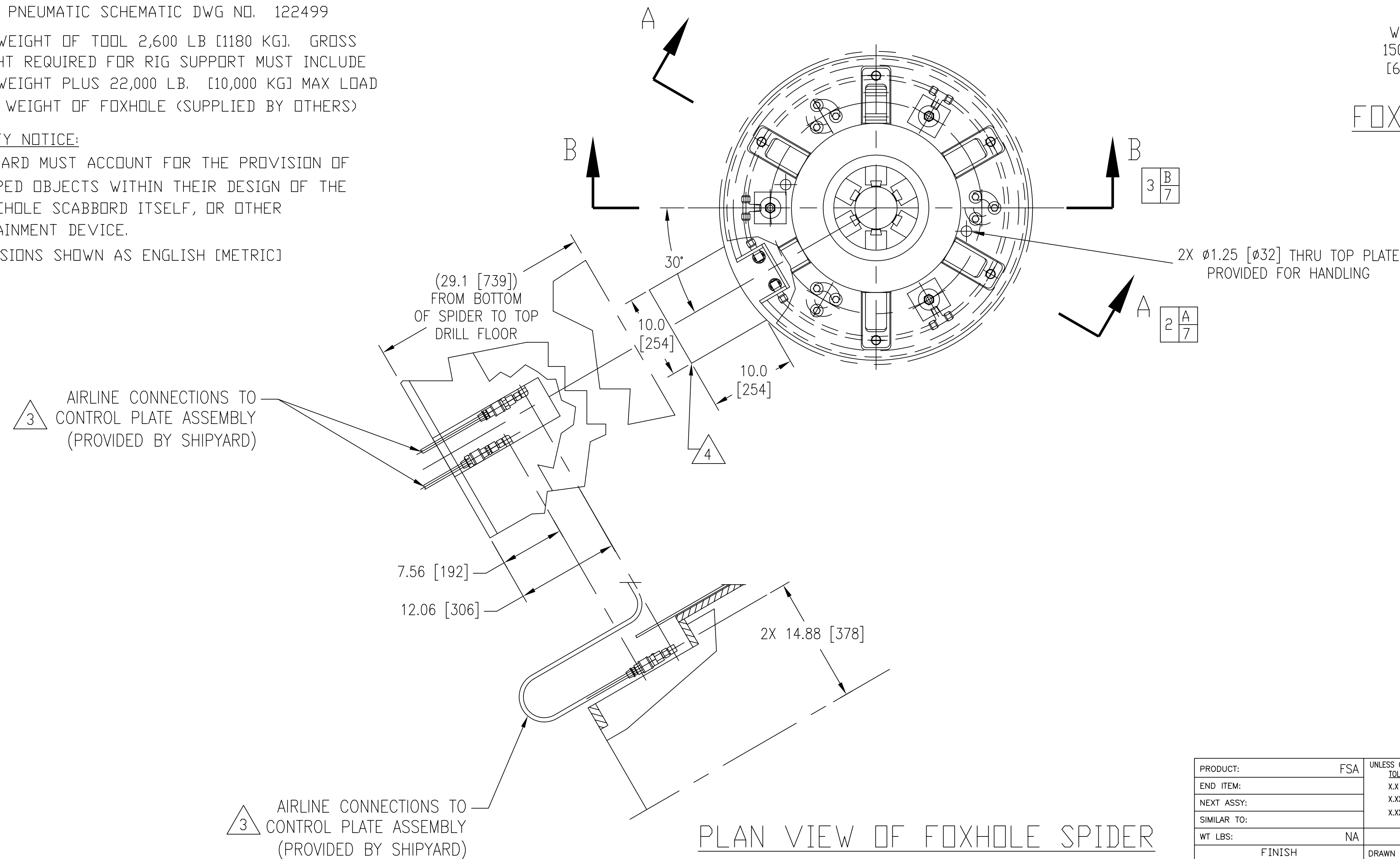
NOTES: UNLESS OTHERWISE SPECIFIED,

- 1 THE FOXHOLE SPIDER ASSEMBLY AS SHOWN IS "DRESSED" FOR RUNNING PIPE FROM 5" TO 9-3/4" OD.
- 2 CONTROL PLATE ASSEMBLY TO BE LOCATED BY SHIPYARD LOCATE WITHIN 40 FEET [12 M] OF FOXHOLE SPIDER ASSEMBLY.
- 3 SHIPYARD TO PROVIDE 1/2" [13] HOSE ASSEMBLIES (2) FROM CONTROL PLATE ASSEMBLY TO FOXHOLE SPIDER ASSEMBLY. HOSE ASSEMBLIES ARE TO HAVE 1/2-14 NPT INTERNAL SWIVEL FITTINGS ON BOTH ENDS. HOSE LENGTH TBD BY SHIPYARD.
- 4 SHIPYARD TO PROVIDE ACCESS TO PNEUMATIC QD CONNECTIONS ON FOXHOLE SPIDER. OPTIONAL METHOD FOR ACCESSING QD'S IS TO LIFT FOXHOLE SPIDER (USING LIFTING HOLE PROVIDED ON FOXHOLE SPIDER) UNTIL REQUIRED ACCESS IS ACHIEVED.
- 5 SHIPYARD TO SUPPLY RIG AIR TO CONTROL PLATE ASSEMBLY AT 90 PSI [6.1 BAR] MINIMUM, 160 PSI [11 BAR] MAXIMUM. PORT IS 1/2-14 NPT INTERNAL.
- 6 SHIPYARD TO SUPPLY FOXHOLE. FOXHOLE INSIDE RECOMMENDED DIAMETER TO BE 18.63 INCHES [473] MINIMUM.
7. REF: PNEUMATIC SCHEMATIC DWG NO. 122499
- 8 NET WEIGHT OF TOOL 2,600 LB [1180 KG]. GROSS WEIGHT REQUIRED FOR RIG SUPPORT MUST INCLUDE NET WEIGHT PLUS 22,000 LB. [10,000 KG] MAX LOAD PLUS WEIGHT OF FOXHOLE (SUPPLIED BY OTHERS)
- 9 SAFETY NOTICE:
SHIPYARD MUST ACCOUNT FOR THE PROVISION OF DROPPED OBJECTS WITHIN THEIR DESIGN OF THE MOUSEHOLE SCABBARD ITSELF, OR OTHER CONTAINMENT DEVICE.
10. DIMENSIONS SHOWN AS ENGLISH [METRIC]

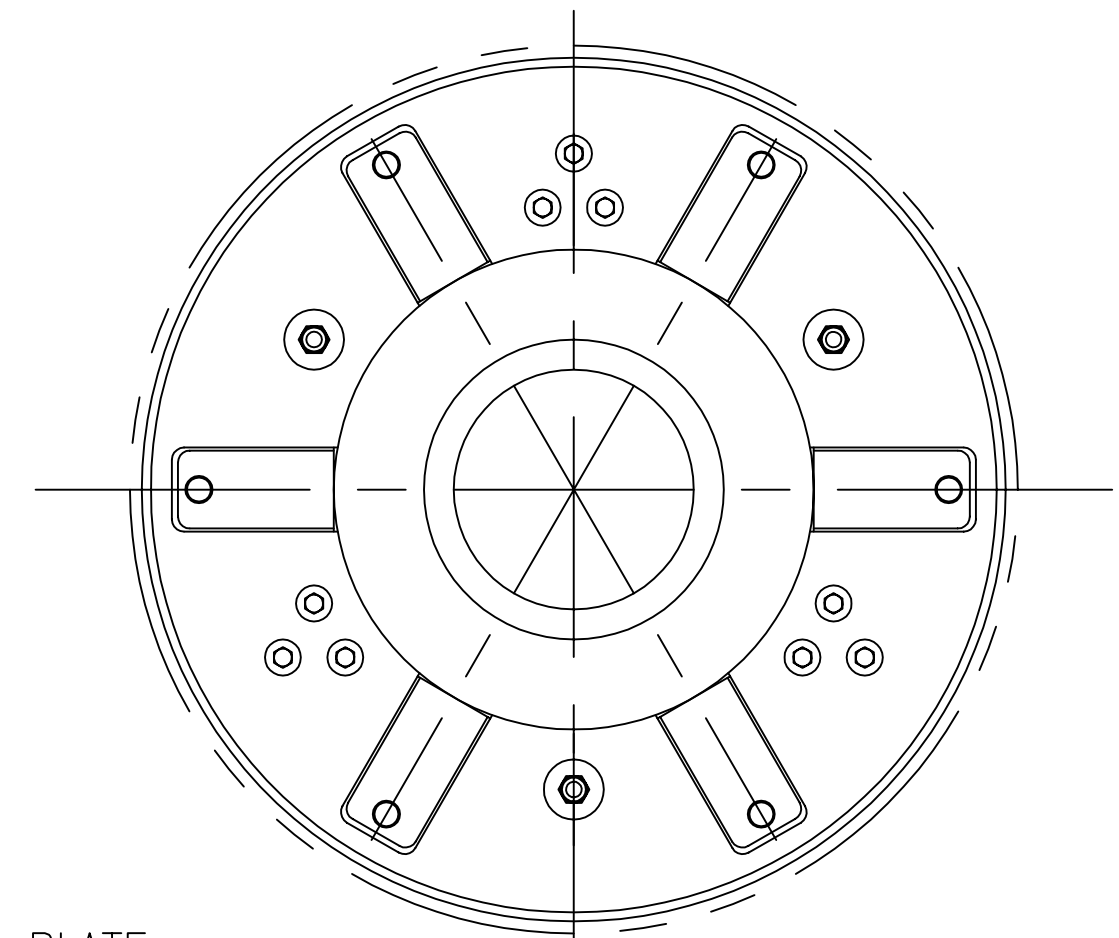
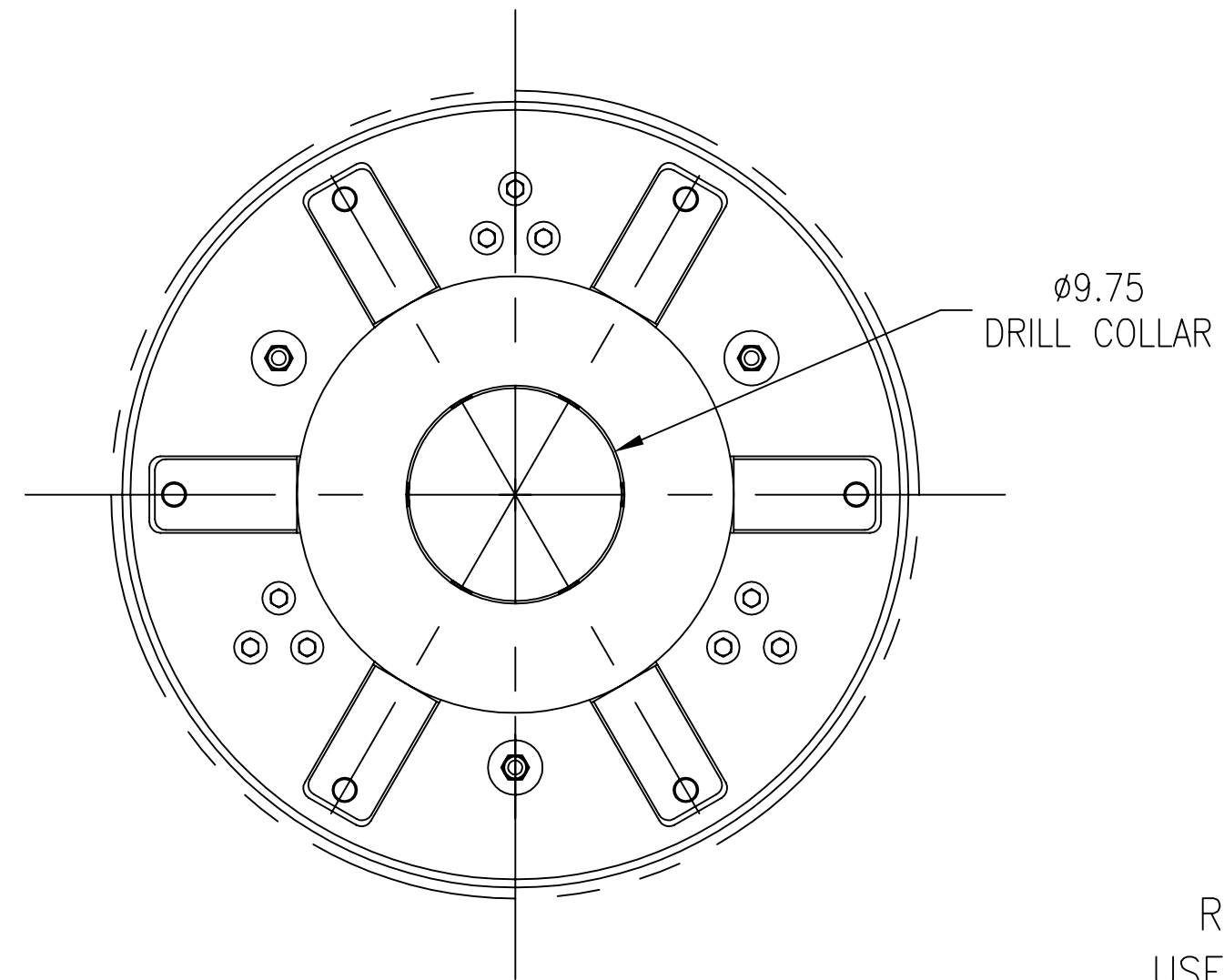
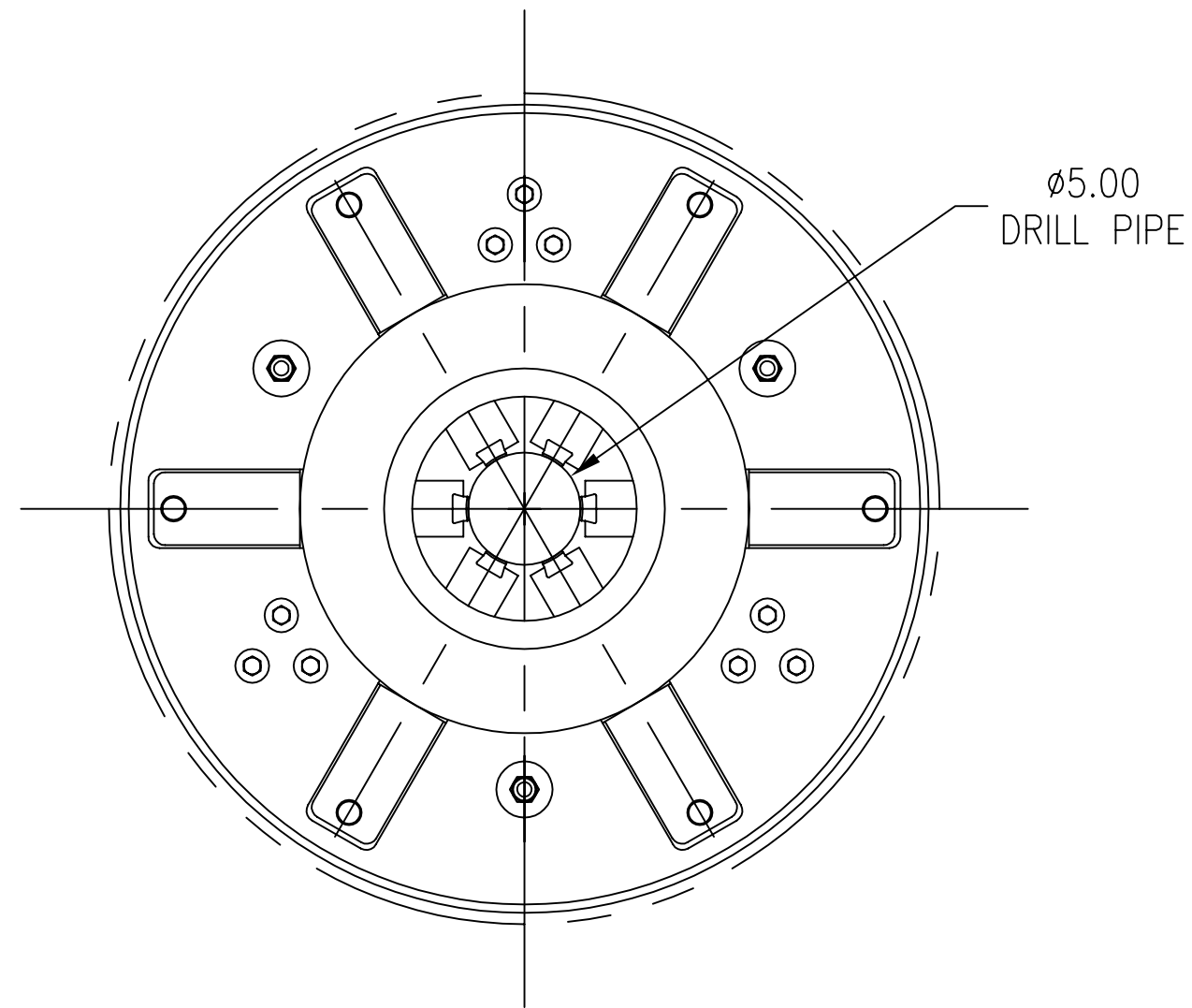
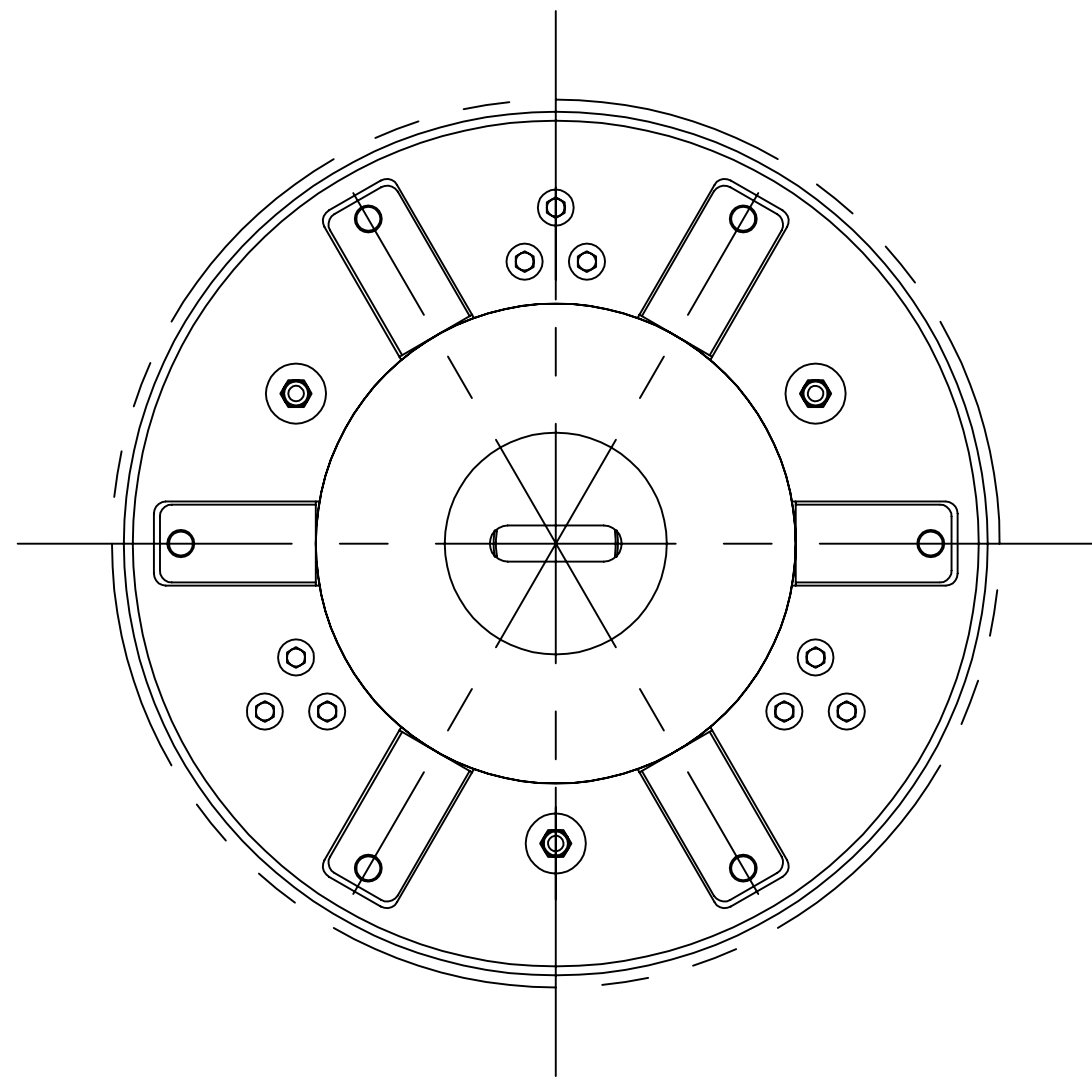


FOXHOLE SPIDER CONTROL PLATE ASSEMBLY

RECOMMENDED MOUNTING ORIENTATION
WEIGHT : 150 LBS (68 KG)
RATED FOR ZONE 1

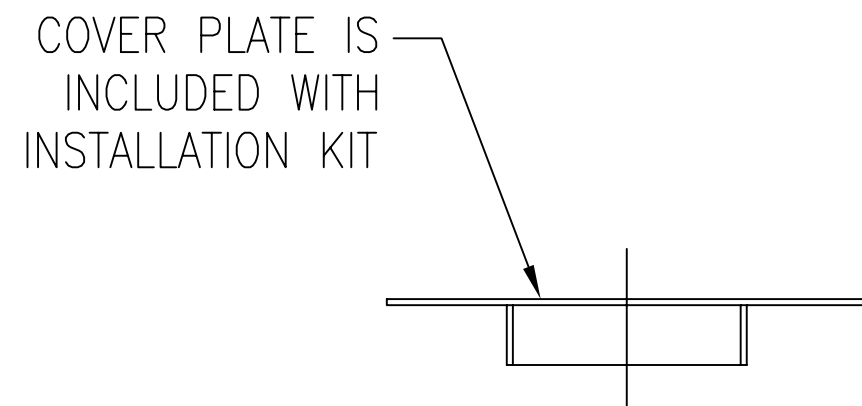


PRODUCT: FSA		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE:		THIS DOCUMENT CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH BELONGS TO NATIONAL OILWELL VARCO, L.P., ITS AFFILIATES OR SUBSIDIARIES (ALL COLLECTIVELY REFERRED TO HEREINAFTER AS "NOW"). IT IS LOANED FOR LIMITED PURPOSES ONLY AND REMAINS THE PROPERTY OF NOW. REPRODUCTION, IN WHOLE OR IN PART, OR USE OF THIS DESIGN OR DISTRIBUTION OF THIS INFORMATION TO OTHERS IS NOT PERMITTED WITHOUT THE EXPRESS WRITTEN CONSENT OF NOW. THIS DOCUMENT IS TO BE RETURNED TO NOW UPON REQUEST OR UPON COMPLETION OF THE USE FOR WHICH IT WAS LOANED. THIS DOCUMENT AND THE INFORMATION CONTAINED AND REPRESENTED HEREIN IS THE COPYRIGHTED PROPERTY OF NOW.		 NATIONAL OILWELL VARCO	
END ITEM: X.X ±.1 ANGLES ±1/2 DEG		X.XX ±.03 FRACTIONS ±1/16		TITLE: GENERAL ARRANGEMENT		FOXHOLE SPIDER	
NEXT ASSY: X.XXX ±.010 BREAK EDGES .02/.03		DO NOT SCALE DRAWING					
SIMILAR TO: NA		CURRENT INITIAL					
WT LBS: FINISH		DRAWN V.LIUZZI K. NGUYEN					
UNLESS OTHERWISE SPECIFIED TOL < ±.06 TOL ≥ ±.06		CHECKED B.WALLIHAN R. MOOERS		RIG SOLUTIONS		SCALE: 1/16 PROJECTION:  SIZE: D SHT: 1 of 4	
250 ✓ 1000 ✓		APPVD B.WALLIHAN R. MOOERS		MECHANICAL ENGINEERING		DWG NO. 30170902 REV: H	
		DATE 10/30/14 9/26/02					



REMOVABLE PLATE
USED WITH (3-1/2"
TO 8-1/4" OD) AND
(5" TO 9-3/4" OD)
SLIP ASSEMBLIES

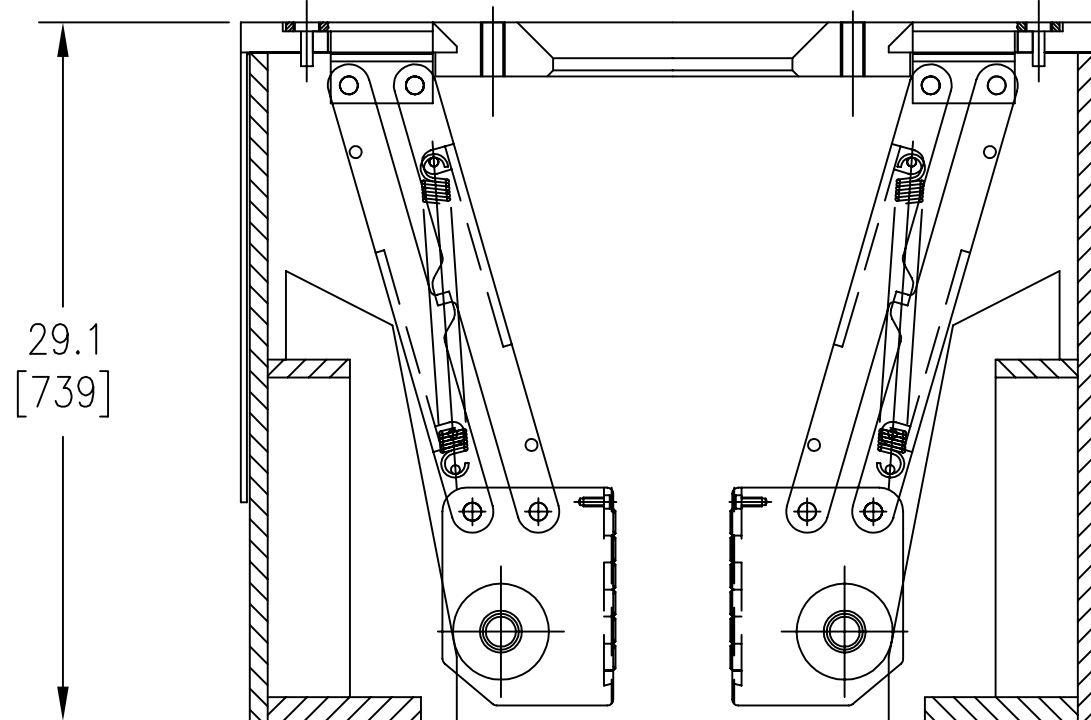
10.00
[254] MAX OPENING WITH PLATE



COVER PLATE IS
INCLUDED WITH
INSTALLATION KIT

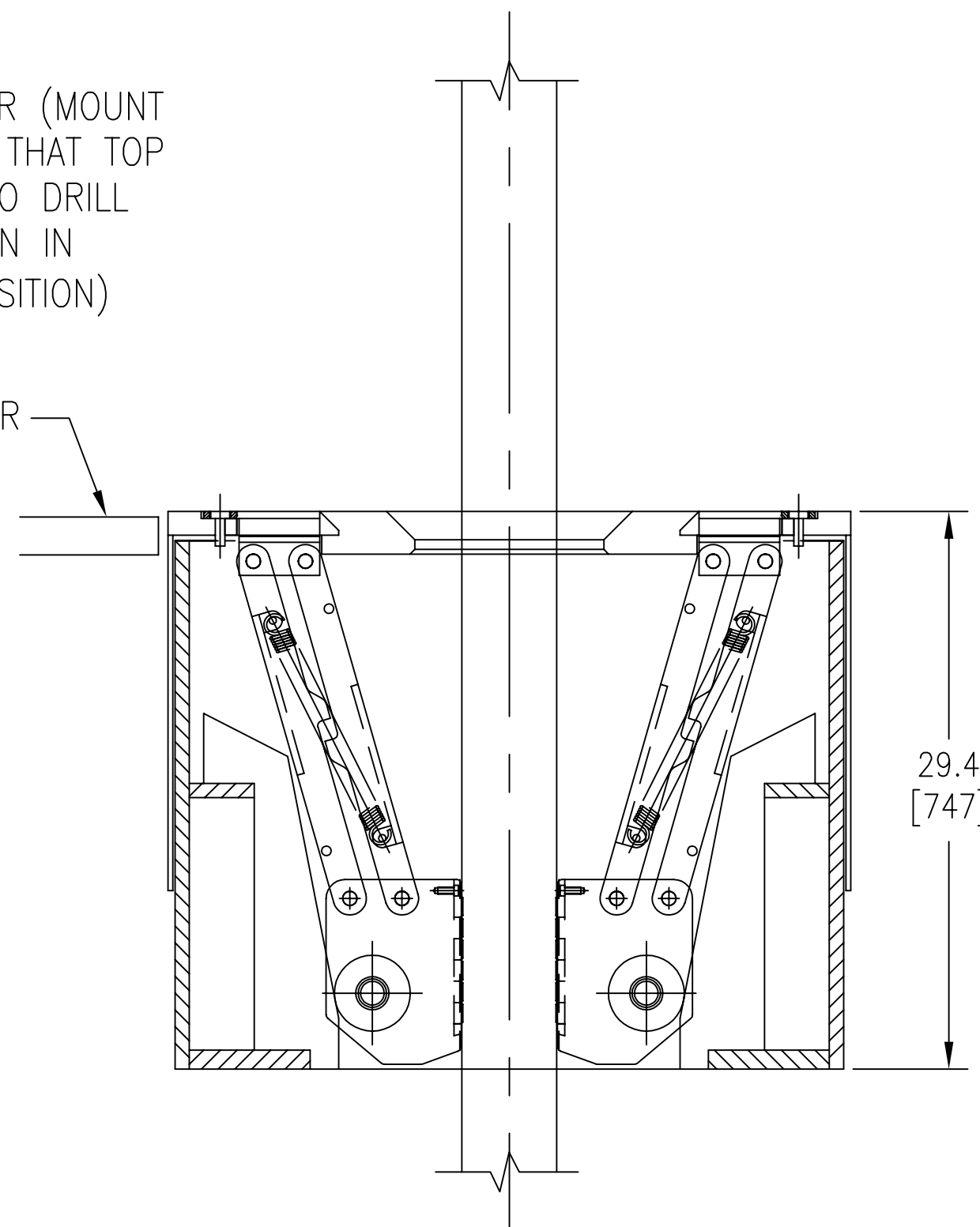
DRILL FLOOR (MOUNT
SPIDER SO THAT TOP
IS FLUSH TO DRILL
FLOOR WHEN IN
STORED POSITION)

DRILL FLOOR



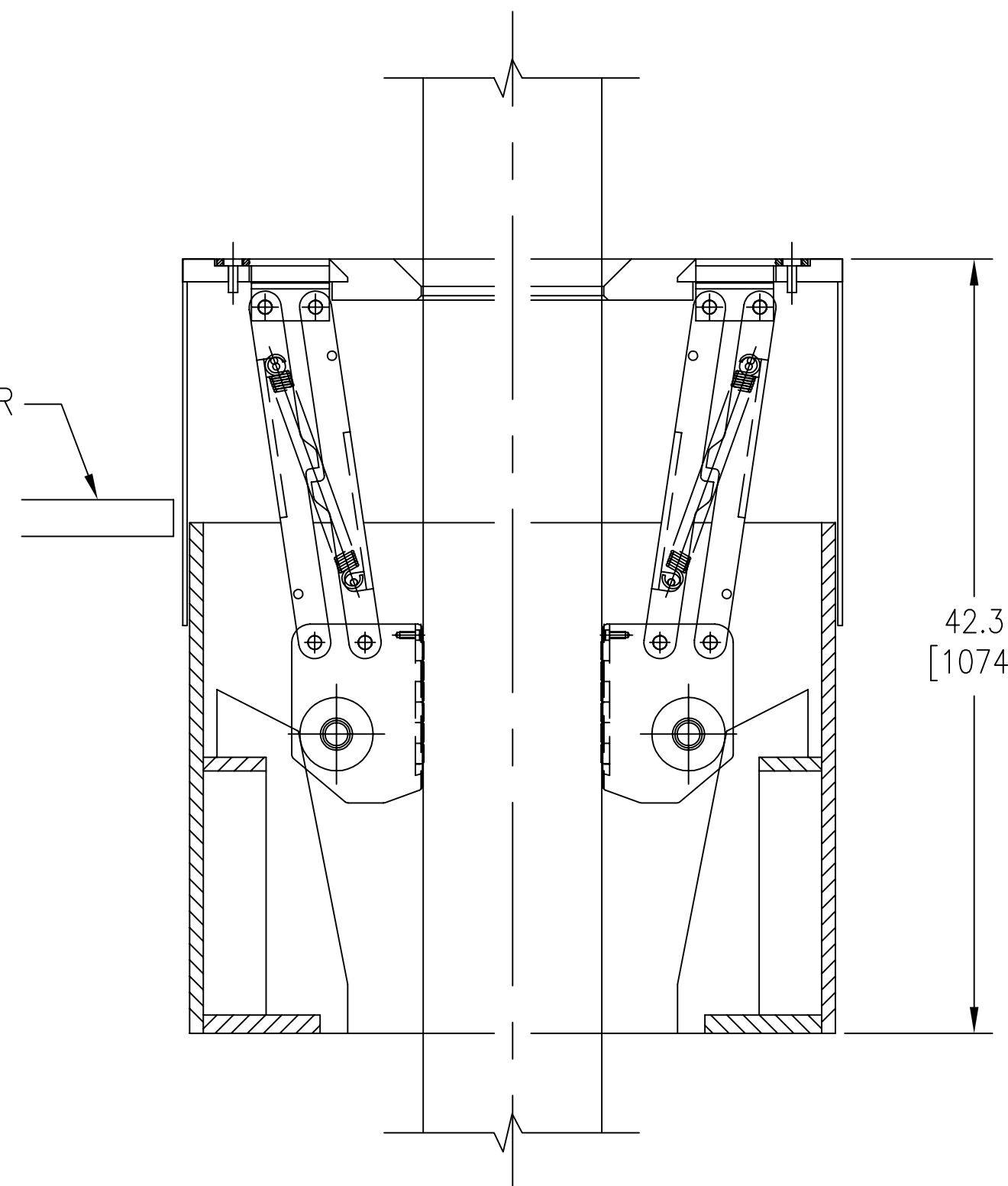
VIEW A-A
ROTATED 30° CCW
SPIDER IN STORED POSITION

1 B
4



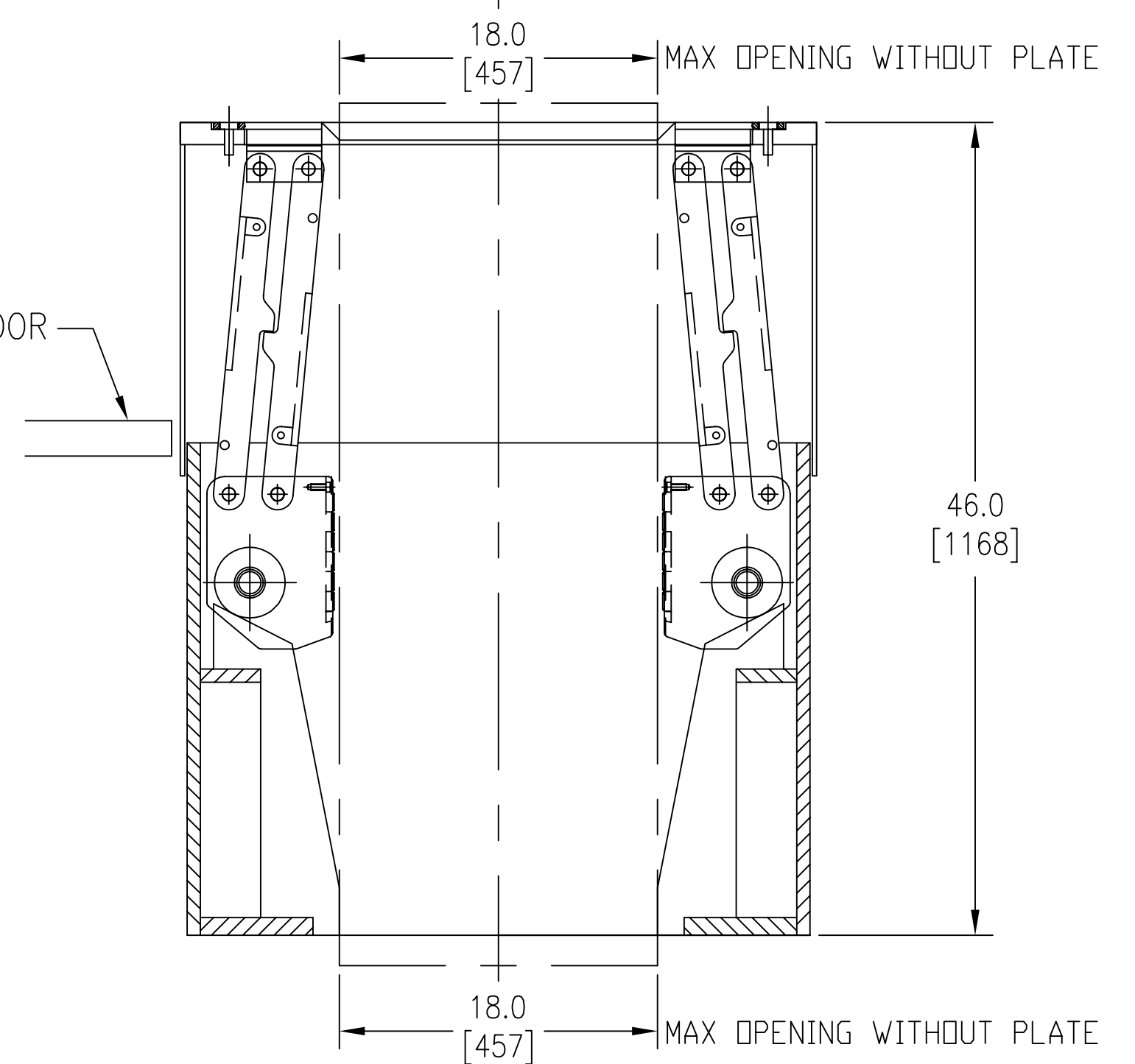
VIEW A-A
ROTATED 30° CCW
SPIDER WITH SLIPS SET
ON 5" OD DRILL PIPE

DRILL FLOOR



VIEW A-A
ROTATED 30° CCW
SPIDER WITH SLIPS SET
ON 9 3/4" OD DRILL COLLAR

DRILL FLOOR



VIEW A-A
ROTATED 30° CCW
SPIDER WITH SLIPS
FULLY OPEN

SCALE:	1/16	PROJECTION:		SIZE:	D	SHT:	2 OF 4
DWG NO.	30170902					REV:	H

8 7 6 5 4 3 2 1

D

D

C

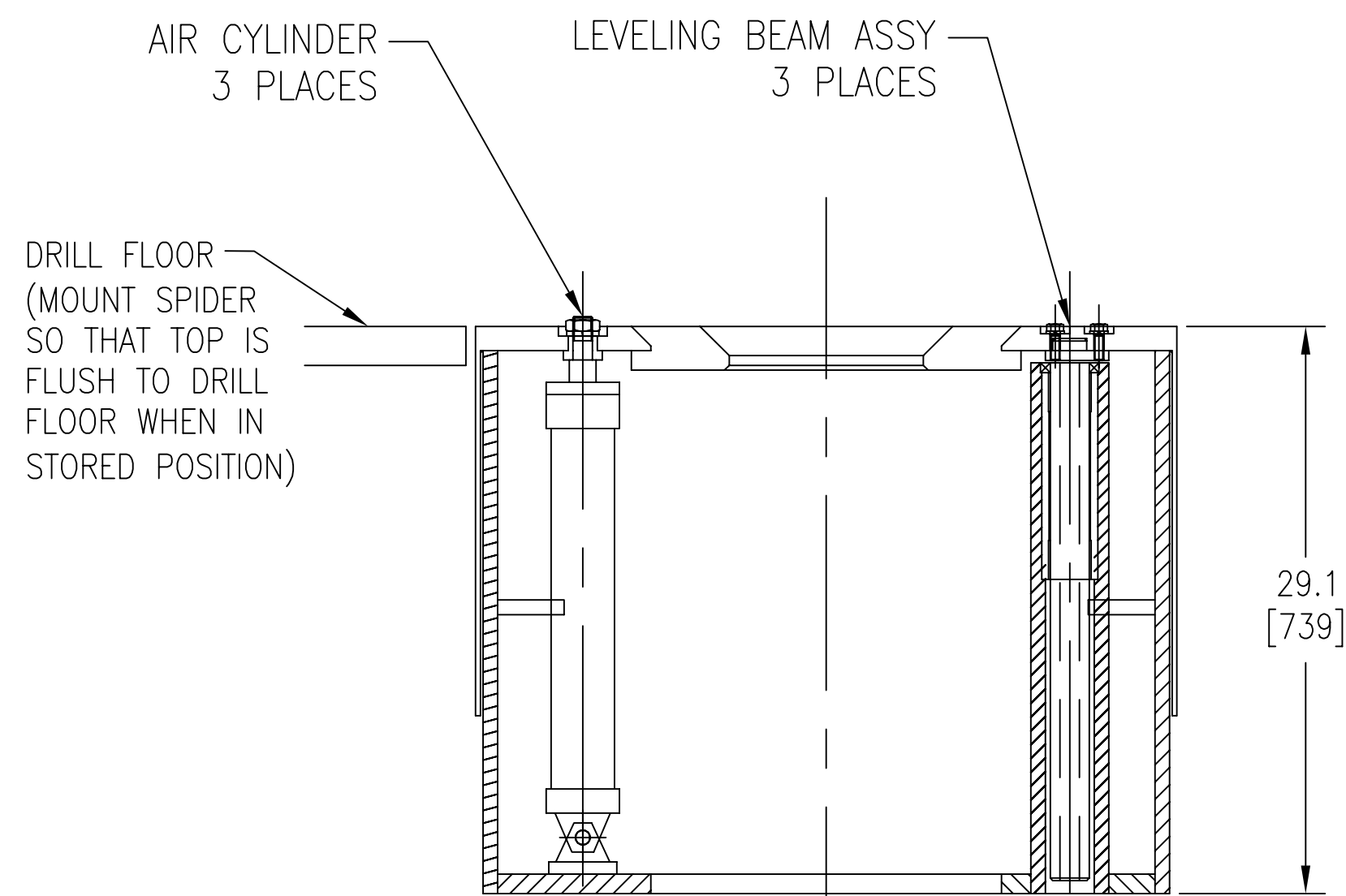
C

B

B

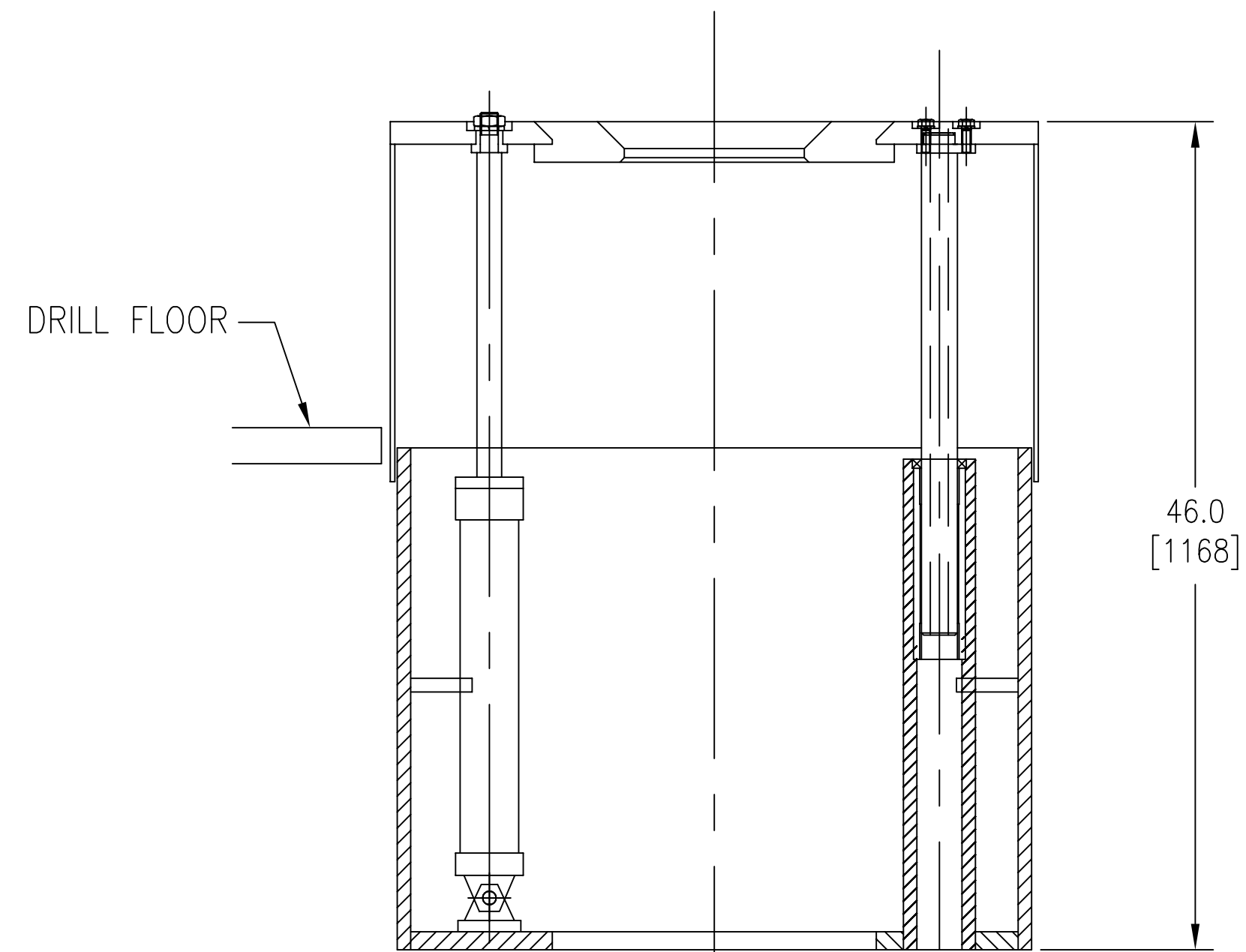
A

A

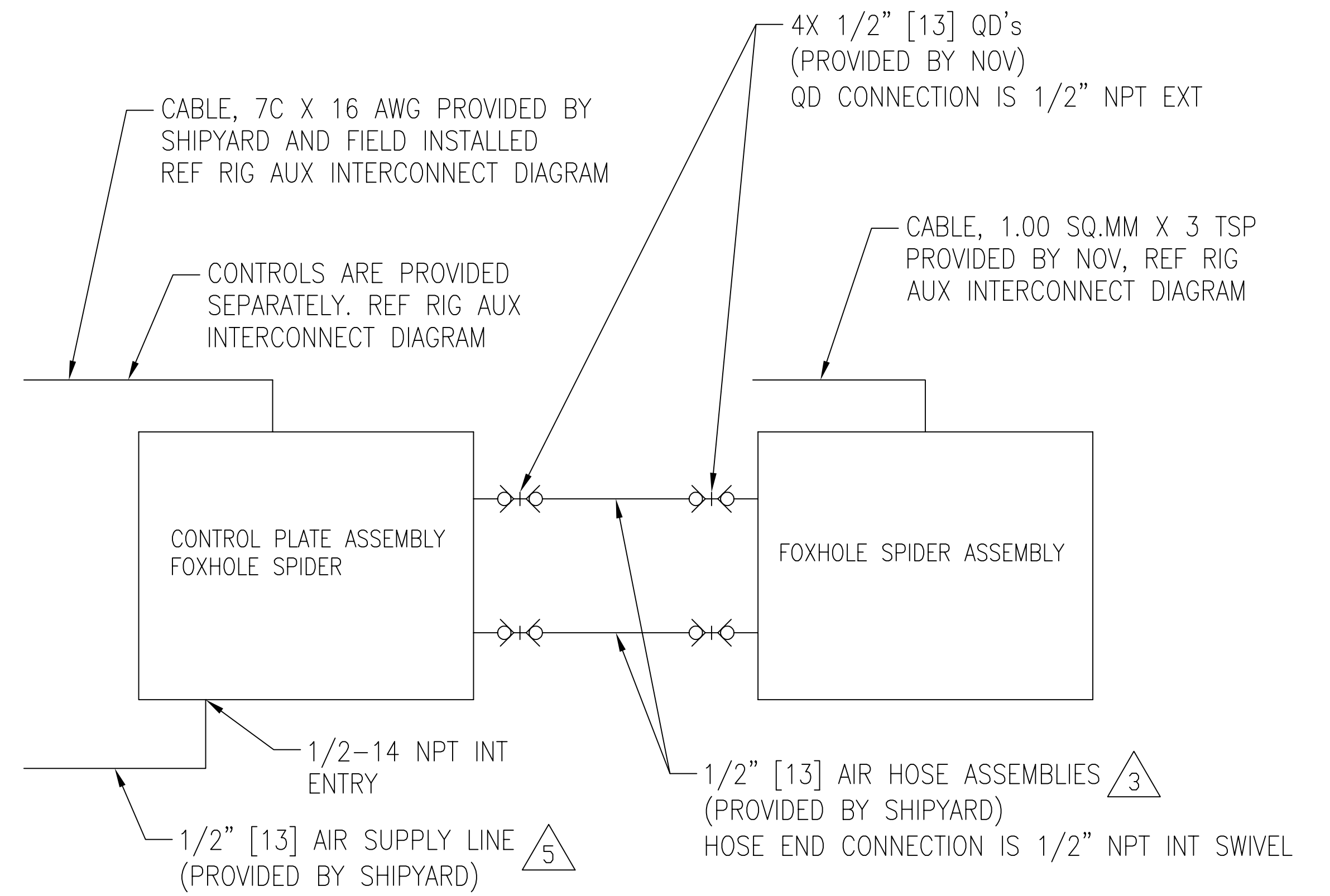


SECTION B-B
STORED POSITION

1 C
4



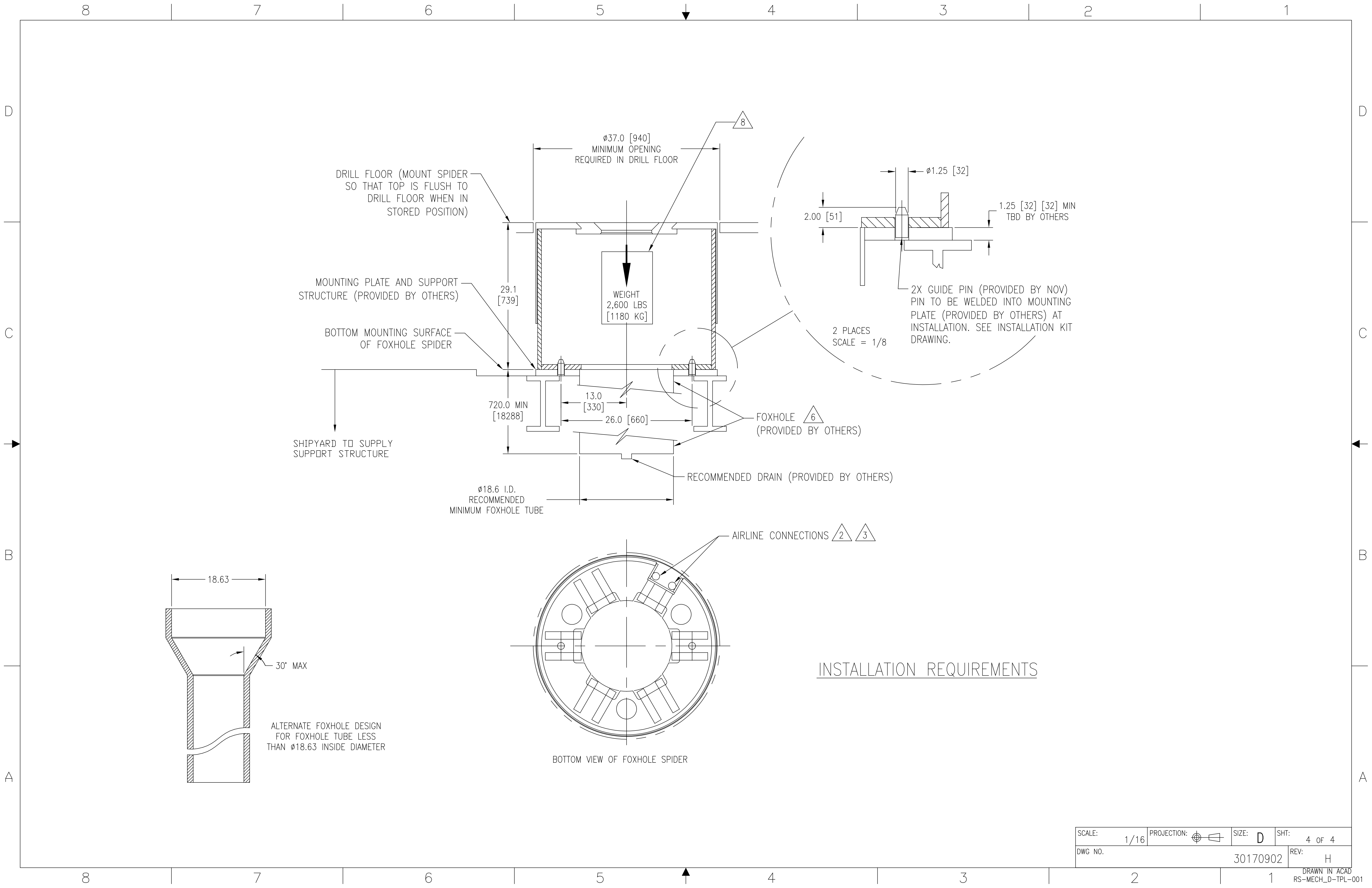
SECTION B-B
FULLY OPENED POSITION

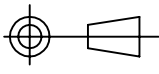


FOXHOLE SPIDER INTERCONNECT DIAGRAM

SCALE:	1/16	PROJECTION:		SIZE:	D	SHT:	3 OF 4
DWG NO.	30170902					REV:	H

8 7 6 5 4 3 2 1



SCALE:	1/16	PROJECTION:		SIZE:	D	SHT:	4 OF 4
DWG NO.	30170902					REV:	H

NOTES: UNLESS OTHERWISE SPECIFIED.

1 THE FOXHOLE SPIDER ASSEMBLY AS SHOWN IS "DRESSED" FOR RUNNING PIPE FROM 5" TO 9-3/4" OD.
AVAILABLE SLIP SETS (PIPE OD RANGE / VARCO PART #):

3-1/2" TO 8-1/4" OD / 121654-3 OPTIONAL
5" TO 9-3/4" OD / 121654-1 INCLUDED
9-5/8" TO 14" OD / 121654-2 OPTIONAL

2 CONTROL PLATE ASSEMBLY (ITEM 1) TO BE LOCATED BY CUSTOMER. LOCATE WITHIN 40 FEET [12 M] OF FOXHOLE SPIDER ASSEMBLY.

3 CUSTOMER TO PROVIDE 1/2" [13] HOSE ASSEMBLIES (2) FROM CONTROL PLATE ASSEMBLY TO FOXHOLE SPIDER ASSEMBLY. HOSE ASSEMBLIES ARE TO HAVE 1/2-14 NPT INTERNAL SWIVEL FITTINGS ON BOTH ENDS. HOSE LENGTH TBD BY CUSTOMER.

4 CUSTOMER TO PROVIDE ACCESS TO PNEUMATIC QD CONNECTIONS ON FOXHOLE SPIDER. OPTIONAL METHOD FOR ACCESSING QD's IS TO LIFT FOXHOLE SPIDER (USING LIFTING HOLE PROVIDED ON FOXHOLE SPIDER) UNTIL REQUIRED ACCESS IS ACHIEVED.

5 CUSTOMER TO SUPPLY RIG AIR TO CONTROL PLATE ASSEMBLY AT 90 PSI [6.1 BAR] MINIMUM. PORT IS 1/2-14 NPT EXT.

6 CUSTOMER TO SUPPLY FOXHOLE. FOXHOLE INSIDE DIAMETER TO BE 18.0 INCHES [457] MINIMUM. FOXHOLE LENGTH TO BE 60 FEET [18.3 M] MINIMUM. FOXHOLE MUST BE SEALED AT BOTTOM WITH DRAIN FITTING PROVIDED BY CUSTOMER.

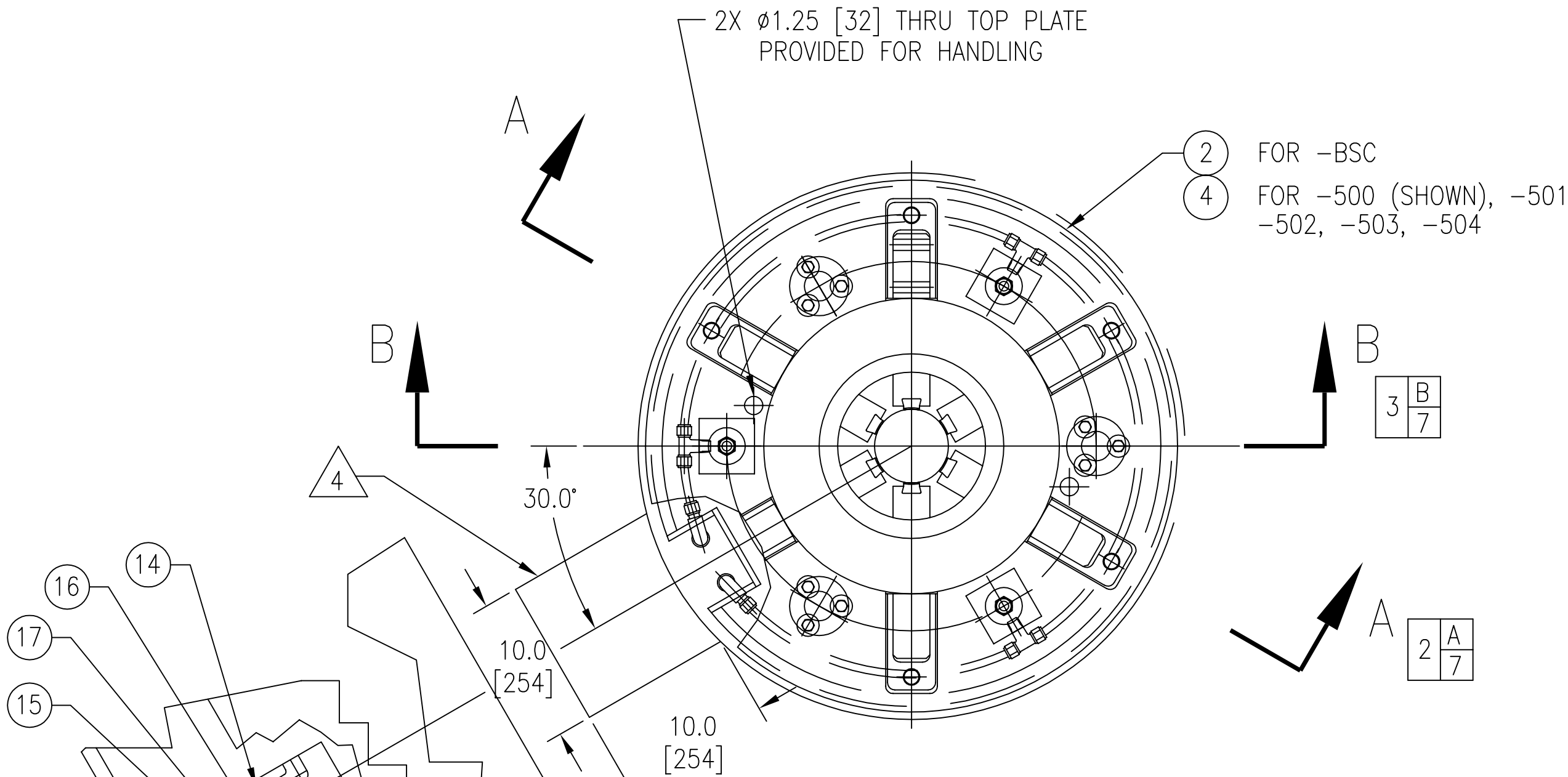
7 CONFIGURATIONS
-BSC USED WHEN FLANGE MOUNTING IS DESIRED (UPON REQUEST)
-500 USED WHEN GUIDE PIN MOUNTING IS DESIRED (STANDARD)
-501 SAME AS -500 BUT WITHOUT THE CONTROL PLATE ASSY
-502 SAME AS -500 PLUS INCLUDES A FOXHOLE CLOSED SENSOR
-503 SAME AS -500 PLUS INCLUDES A LOCAL CONTROL STATION
-504 SAME AS -502 PLUS INCLUDES A LOCAL CONTROL STATION
SEE SHEET 4 FOR MOUNTING REQUIREMENTS

8 REF: PNEUMATIC SCHEMATIC DWG NO. 122499

9 NET WEIGHT OF TOOL 2,600 LB [1180 KG].
GROSS WEIGHT REQUIRED FOR RIG SUPPORT MUST INCLUDE NET WEIGHT PLUS 22,000 LB. [10,000 KG] MAX LOAD PLUS WEIGHT OF FOXHOLE (SUPPLIED BY OTHERS)

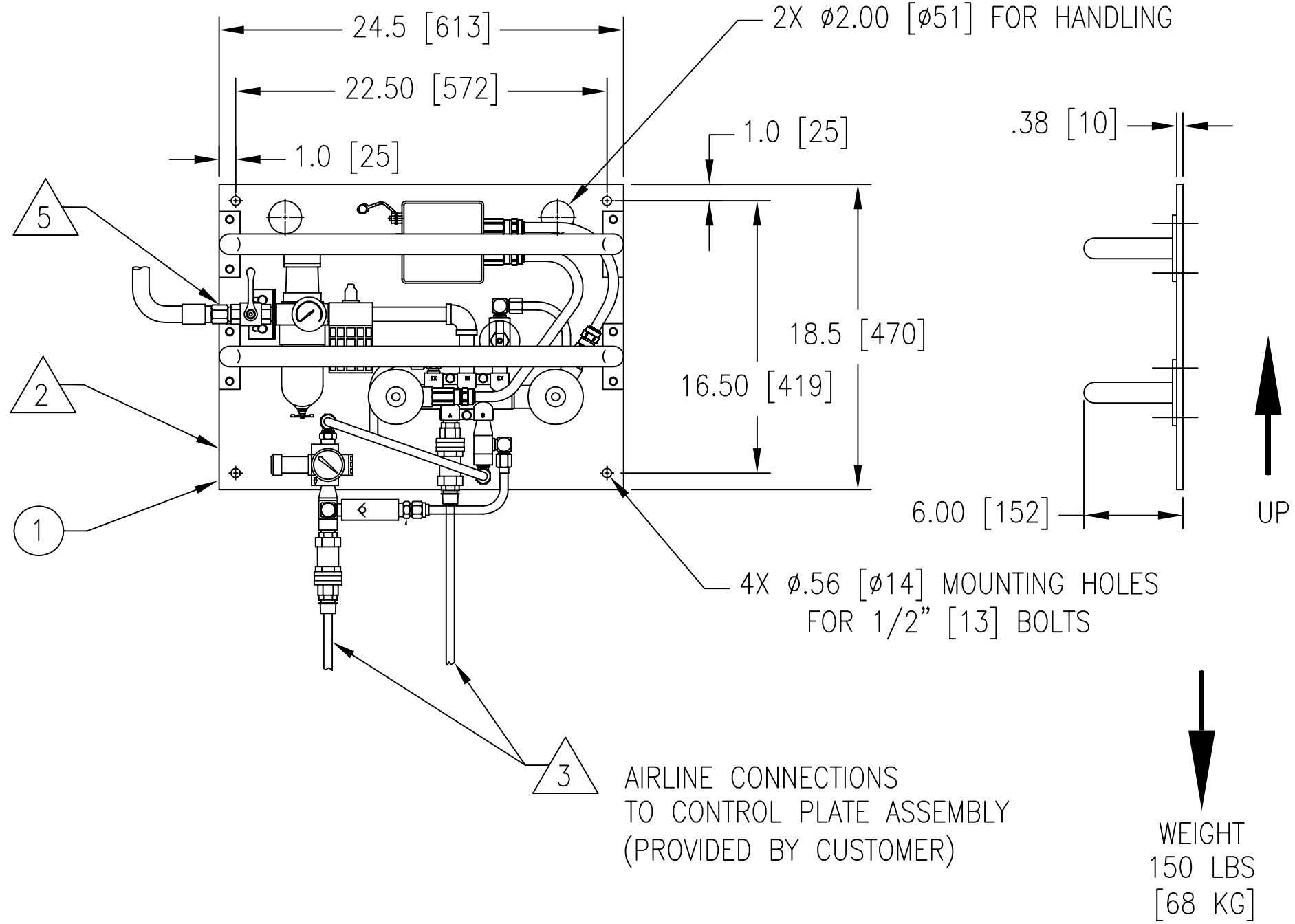
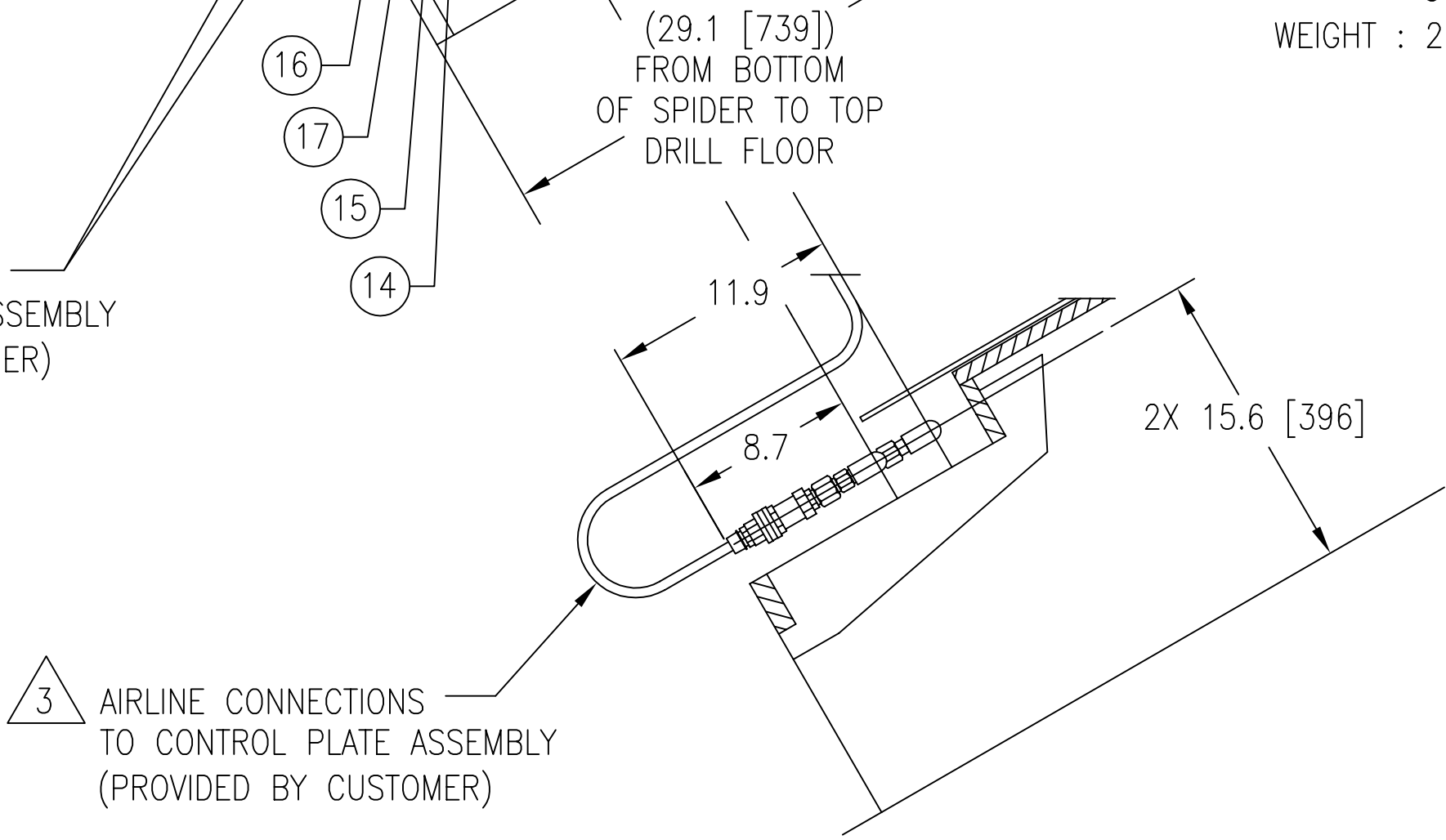
10 SAFETY NOTICE:
CUSTOMER MUST ACCOUNT FOR THE PROVISION OF DROPPED OBJECTS WITHIN THEIR DESIGN OF THE MOUSEHOLE SCABBORD ITSELF, OR OTHER CONTAINMENT DEVICE.

11. DIMENSIONS SHOWN AS ENGLISH [METRIC]



PLAN VIEW OF FOXHOLE SPIDER

-500 SHOWN
WEIGHT : 2,600 LBS [1180 KG]

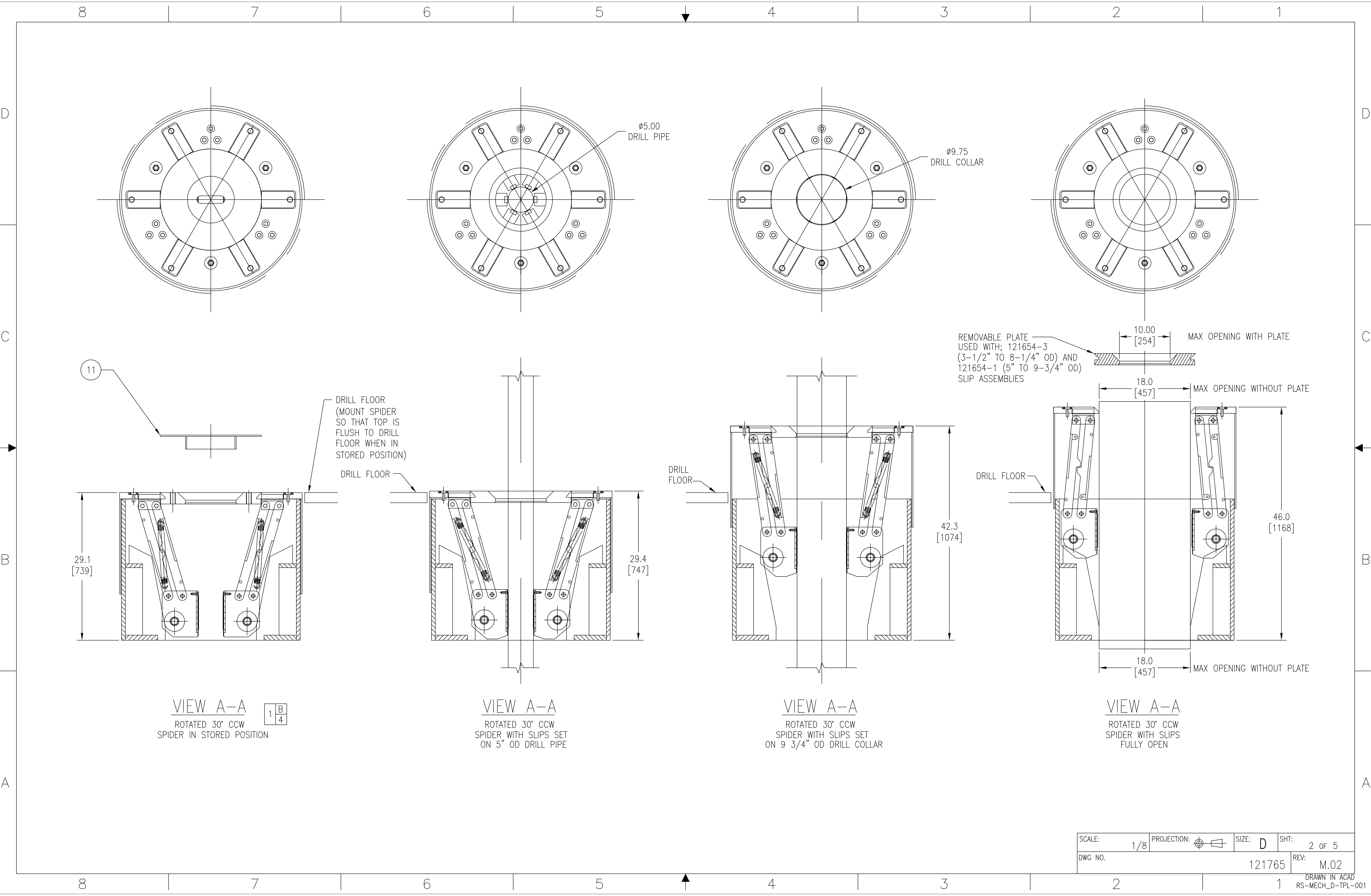


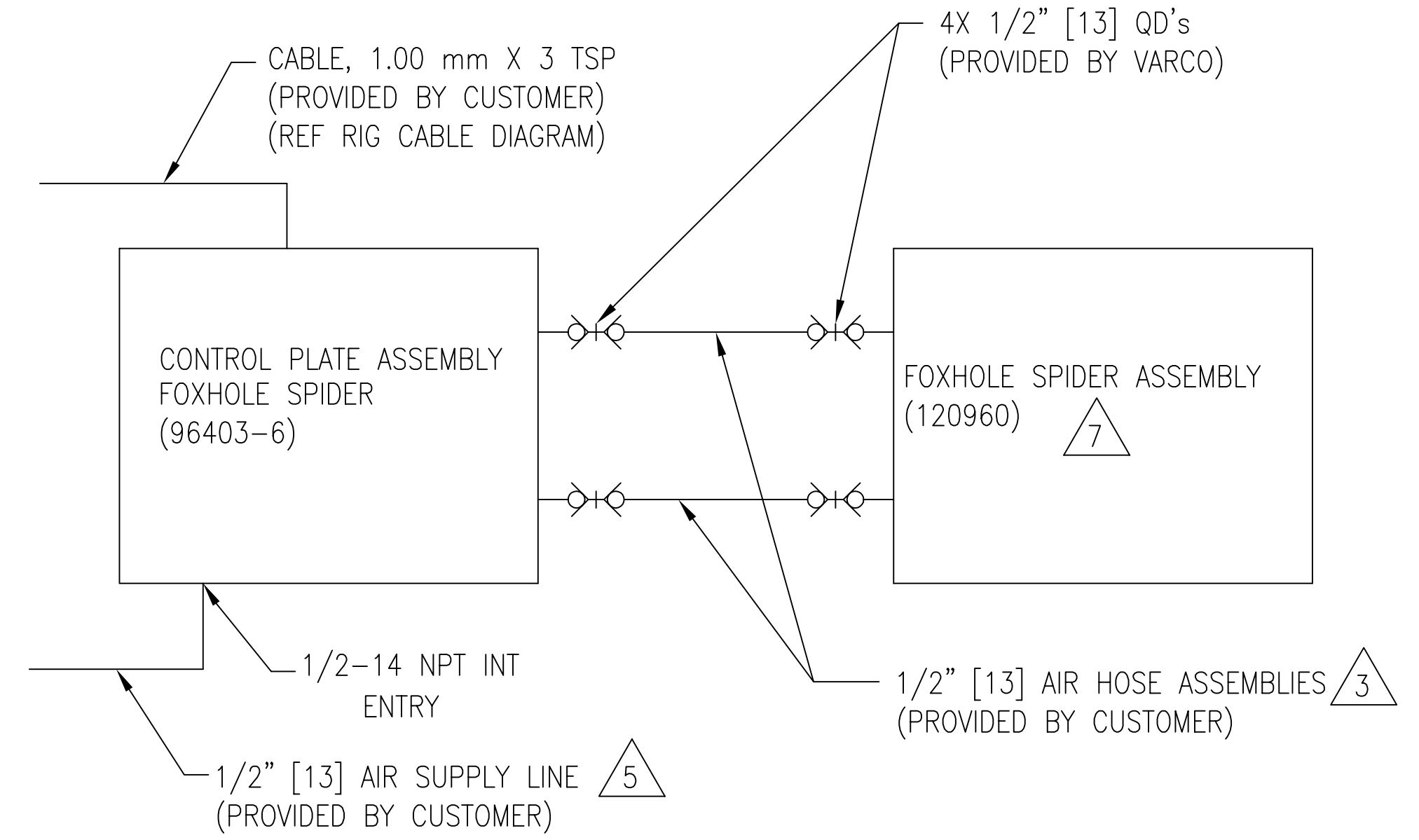
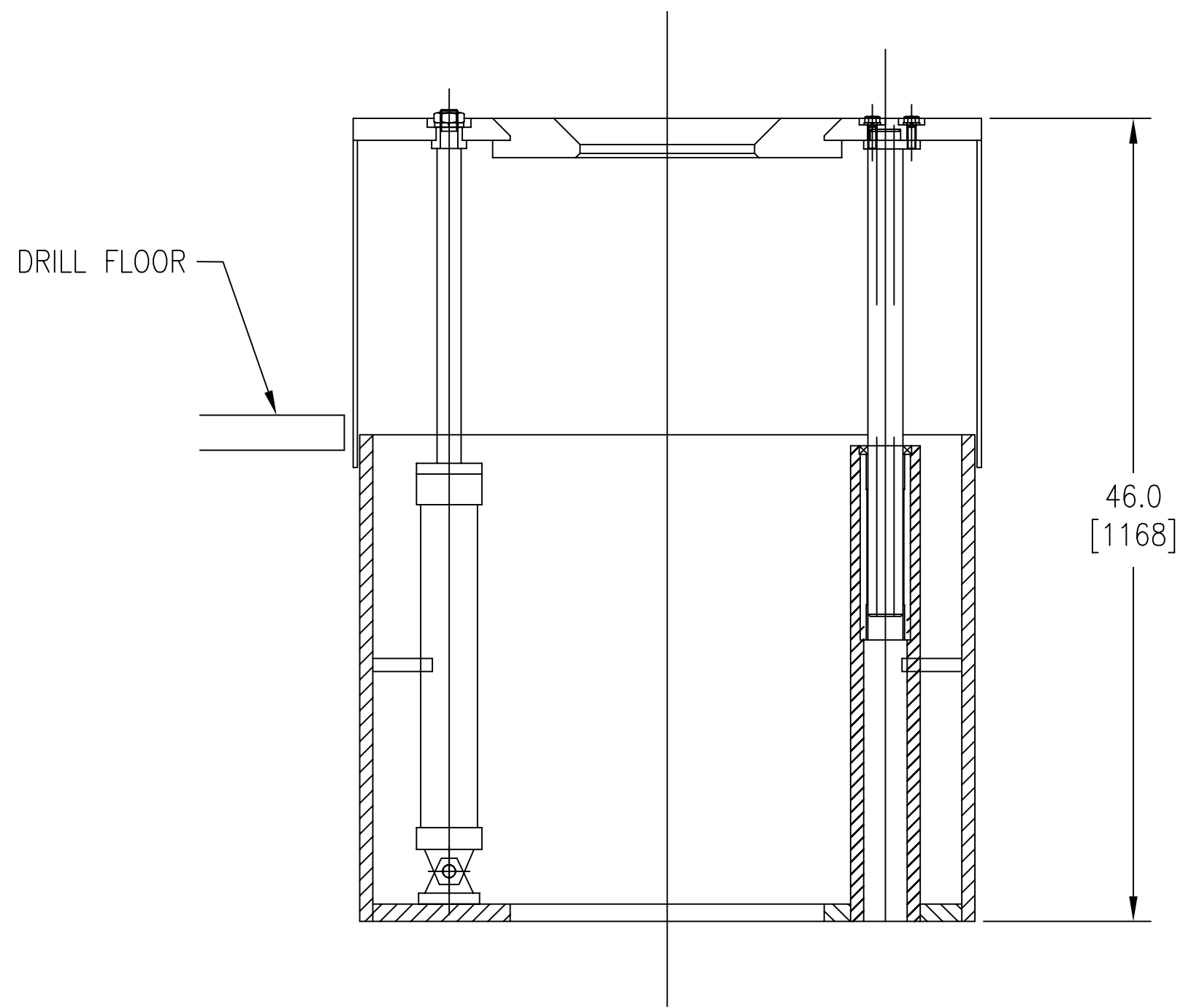
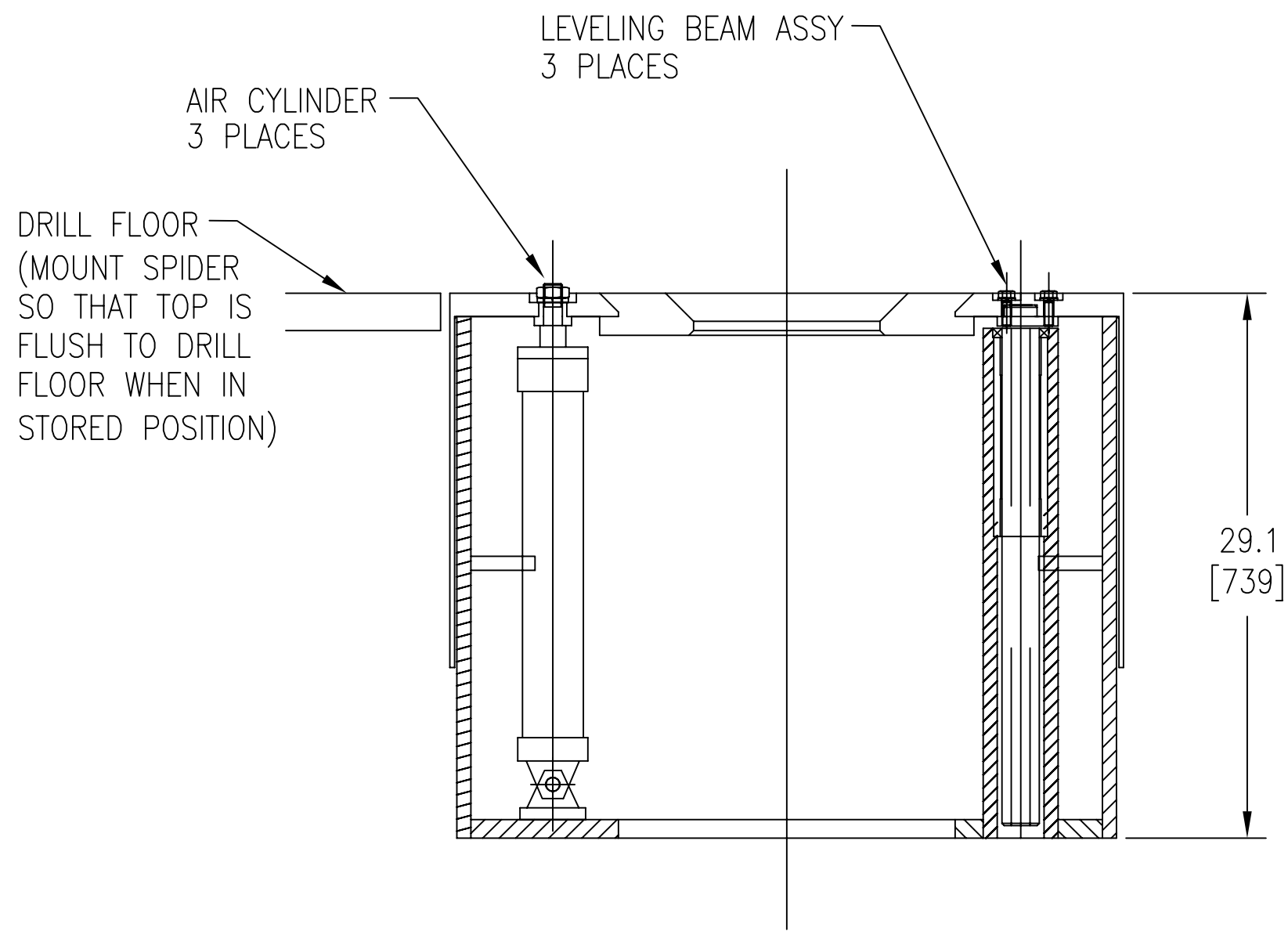
FOXHOLE SPIDER CONTROL PLATE ASSEMBLY

RECOMMENDED MOUNTING ORIENTATION
WEIGHT : 150 LBS [68 KG]

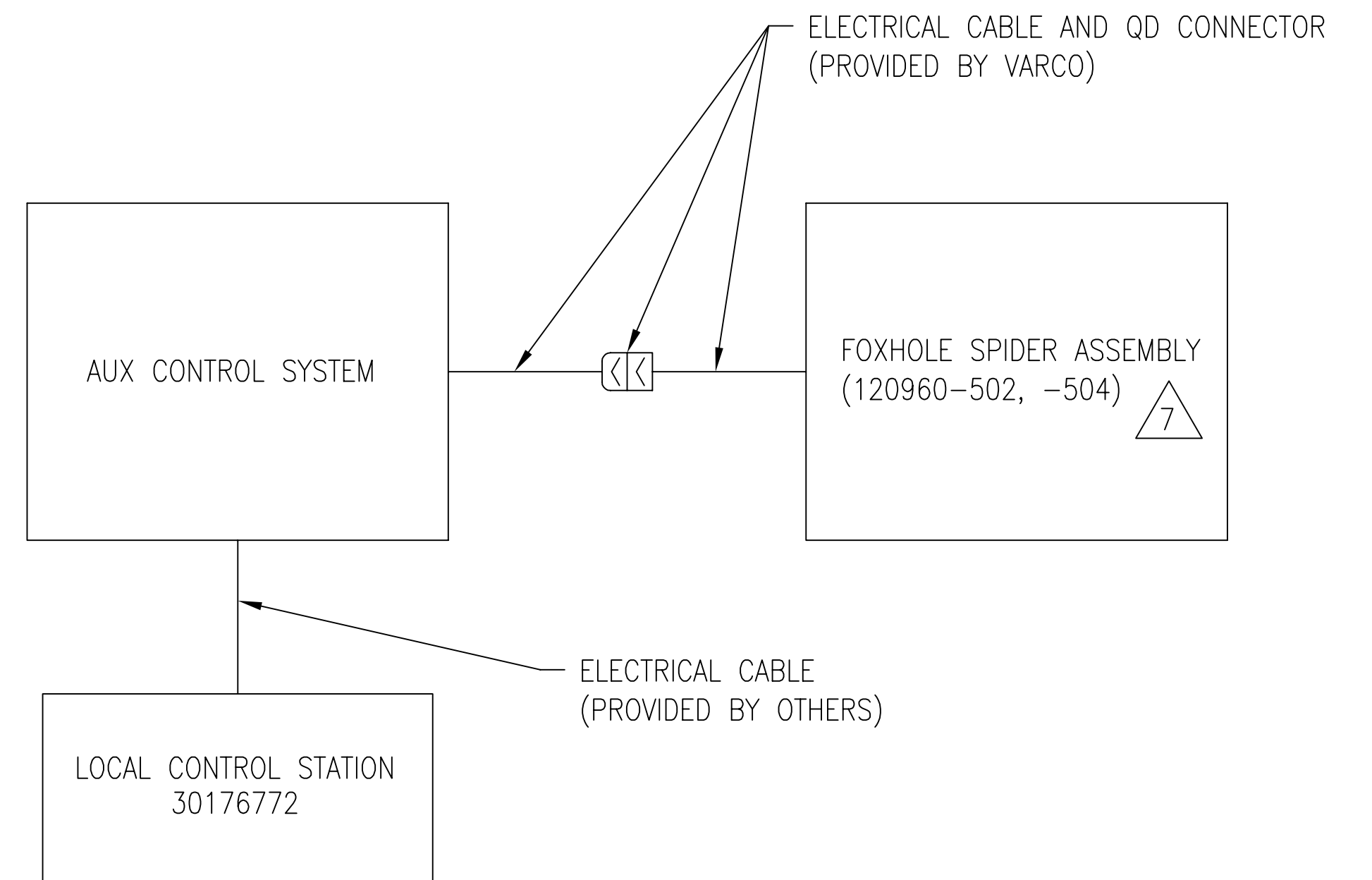
2	2	2	2	2	2	30007843	COUPLER, QUICK-DISCONNECT		17
2	2	2	2	2	2	30007735	NIPPLE, COUPLER - MALE		16
2	2	2	2	2	2	56703-8-8-S	PIPE, NIPPLE		15
2	2	2	2	2	2	56549-8-8-S	CONNECTOR, INT PIPE / SWIVEL INT 37"		14
1	-	1	-	-	-	30158656-100	CABLE ASSEMBLY, CONNECTORIZED		13
1	1	-	-	-	-	M614002913-05	GLAND, ARMORED M20		12
1	1	1	1	1	1	30156889	COVER PLATE		11
1	1	1	1	1	1	122499-DWG	PNUEMATIC, SCHEMATIC		10
2	2	2	2	2	-	122004	PIN, GUIDE		9
-	-	-	-	-	-	-	-		8
1	1	-	-	-	-	30176772	CONTROL STATION, LOCAL		7
1	-	1	-	-	-	120960-2-S	ASSEMBLY, FOX HOLE SPIDER		6
-	-	-	-	-	-	-	-		5
-	1	-	1	1	-	120960-2	ASSEMBLY, FOXHOLE SPIDER		4
1	1	1	1	1	1	121765-DWG	INSTALLATION KIT, FOXHOLE ASSEMBLY - DWG		3
-	-	-	-	-	1	120960	ASSEMBLY, FOXHOLE SPIDER		2
1	1	1	-	1	1	96403-6	CONTROL PLATE ASSEMBLY		1
-504	-503	-502	-501	-500	BSC	PART NO.	DESCRIPTION	MATERIAL	ITEM NO.
QTY REQD						LIST OF MATERIAL			

PRODUCT: FOXHOLE		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE:		THIS DOCUMENT CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH BELONGS TO NATIONAL OILWELL VARCO, L.P., ITS AFFILIATES OR SUBSIDIARIES (ALL COLLECTIVELY REFERRED TO HEREINAFTER AS "NOV"). IT IS LOANED FOR LIMITED PURPOSES ONLY AND REMAINS THE PROPERTY OF NOV. REPRODUCTION, IN WHOLE OR IN PART, OR USE OF THIS DESIGN OR DISTRIBUTION OF THIS INFORMATION TO OTHERS IS NOT PERMITTED WITHOUT THE EXPRESS WRITTEN CONSENT OF NOV. THIS DOCUMENT IS TO BE RETURNED TO NOV UPON REQUEST OR UPON COMPLETION OF THE USE FOR WHICH IT WAS LOANED. THIS DOCUMENT AND THE INFORMATION CONTAINED AND REPRESENTED HEREIN IS THE COPYRIGHTED PROPERTY OF NOV. NOV NATIONAL OILWELL VARCO TITLE: KIT, INSTALLATION, FOXHOLE SPIDER ASSY			
END ITEM:		X.X ±.1	ANGLES ±1/2 DEG				
NEXT ASSY: 30173554		X.XX ±.03	FRACTIONS ±1/16				
SIMILAR TO:		X.XXX ±.010	BREAK EDGES .02/.03				
WT LBS:		DO NOT SCALE DRAWING					
FINISH		CURRENT	INITIAL	RIG SOLUTIONS MECHANICAL ENGINEERING			
UNLESS OTHERWISE SPECIFIED TOL < ±.06 TOL ≥ ±.06		DRAWN J.McCORMACK	W. WINSLOW				
250 ✓	1000 ✓	CHECKED V. LIUZZI	D. YENZER				
		APPVD V. LIUZZI	D. YENZER				
		DATE 2/24/2015	7/1997				
				SCALE: 1/8	PROJECTION: 	SIZE: D	SHT: 1 of 5
				DWG NO.	121765		REV: M.02





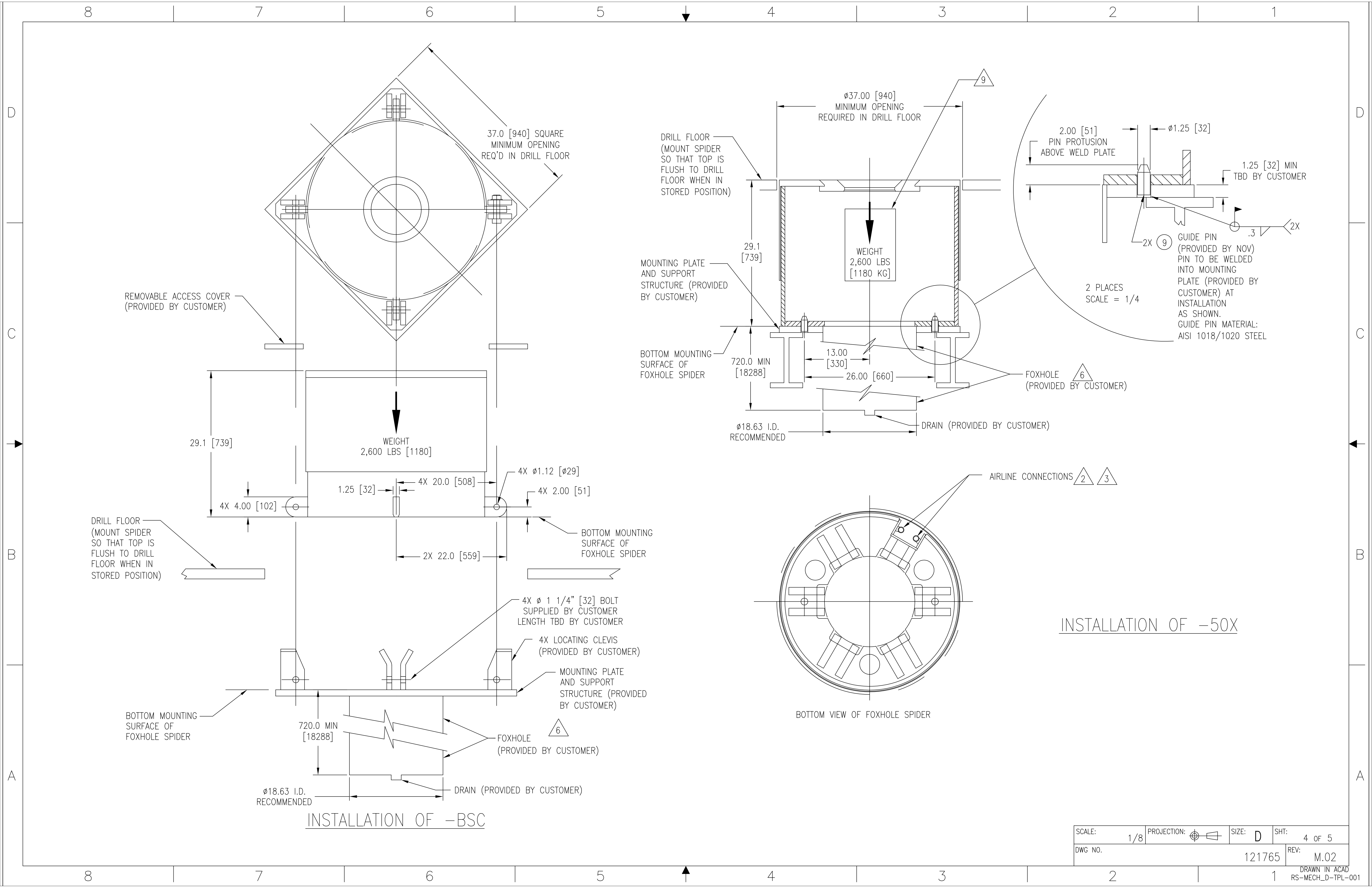
FOXHOLE SPIDER PNEUMATIC INTERCONNECT DIAGRAM



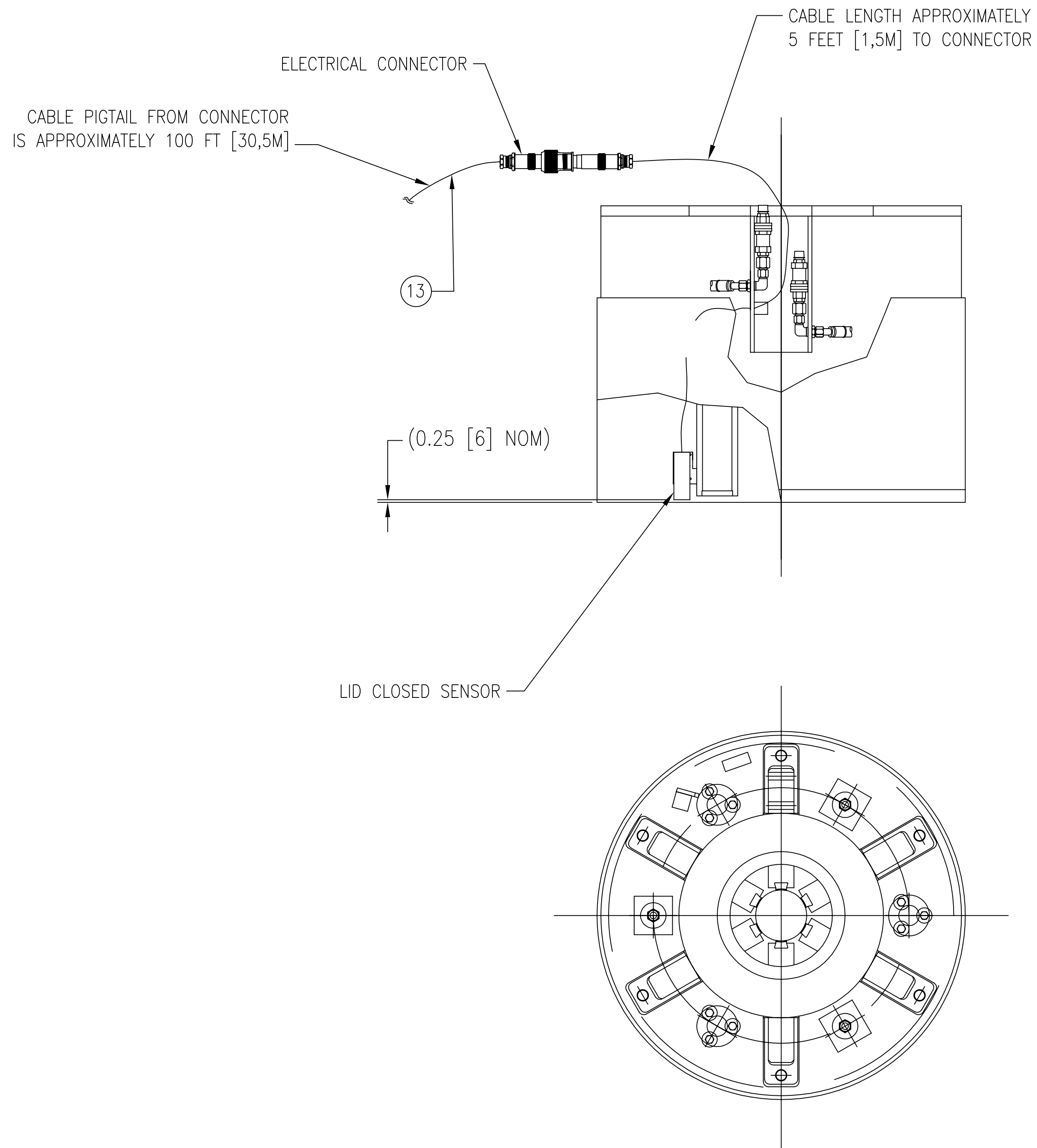
FOXHOLE SPIDER ELECTRICAL INTERCONNECT DIAGRAM

121765-502, -503 AND -504 AS APPLICABLE

SCALE:	1/8	PROJECTION:		SIZE:	D	SHT:	3 OF 5
DWG NO.	121765	REV:	M.02	DRAWN IN ACAD RS-MECH_D-TPL-001			

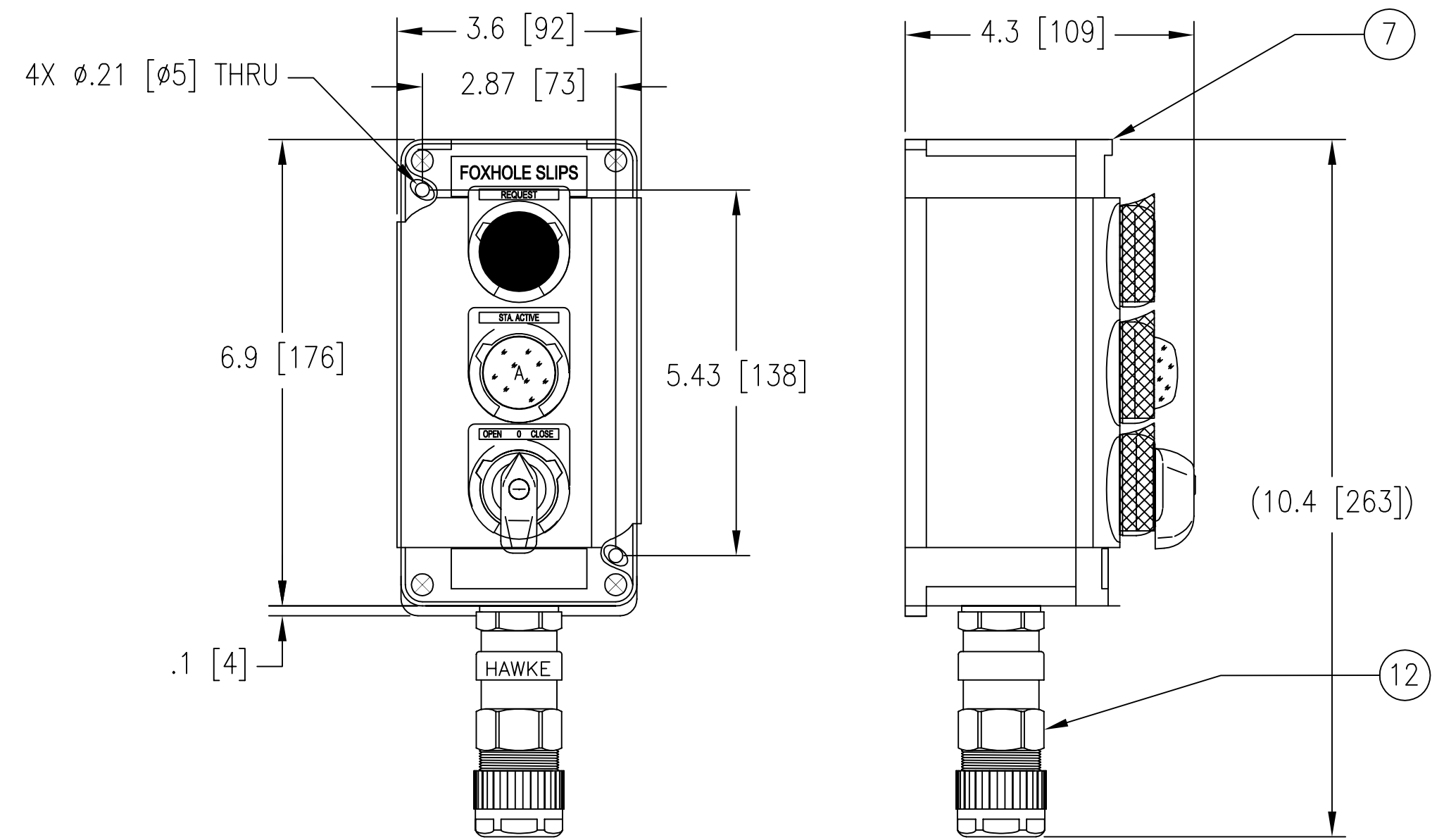


8 7 6 5 4 3 2 1



CABLE INSTALLATION OF -502 CONFIGURATION

ALL PHYSICAL AND AIR HOSE DETAILS ARE IDENTICAL ON ALL -50X VERSIONS
THIS VIEW SHOWS CABLING DETAILS FOR -502 AND -504 CONFIGURATIONS ONLY



ITEM 7 LOCAL CONTROL STATION

SCALE = 4:1

CABLING FROM LOCAL CONTROL STATION TO
CONTROL SYSTEM IS PROVIDED BY OTHERS

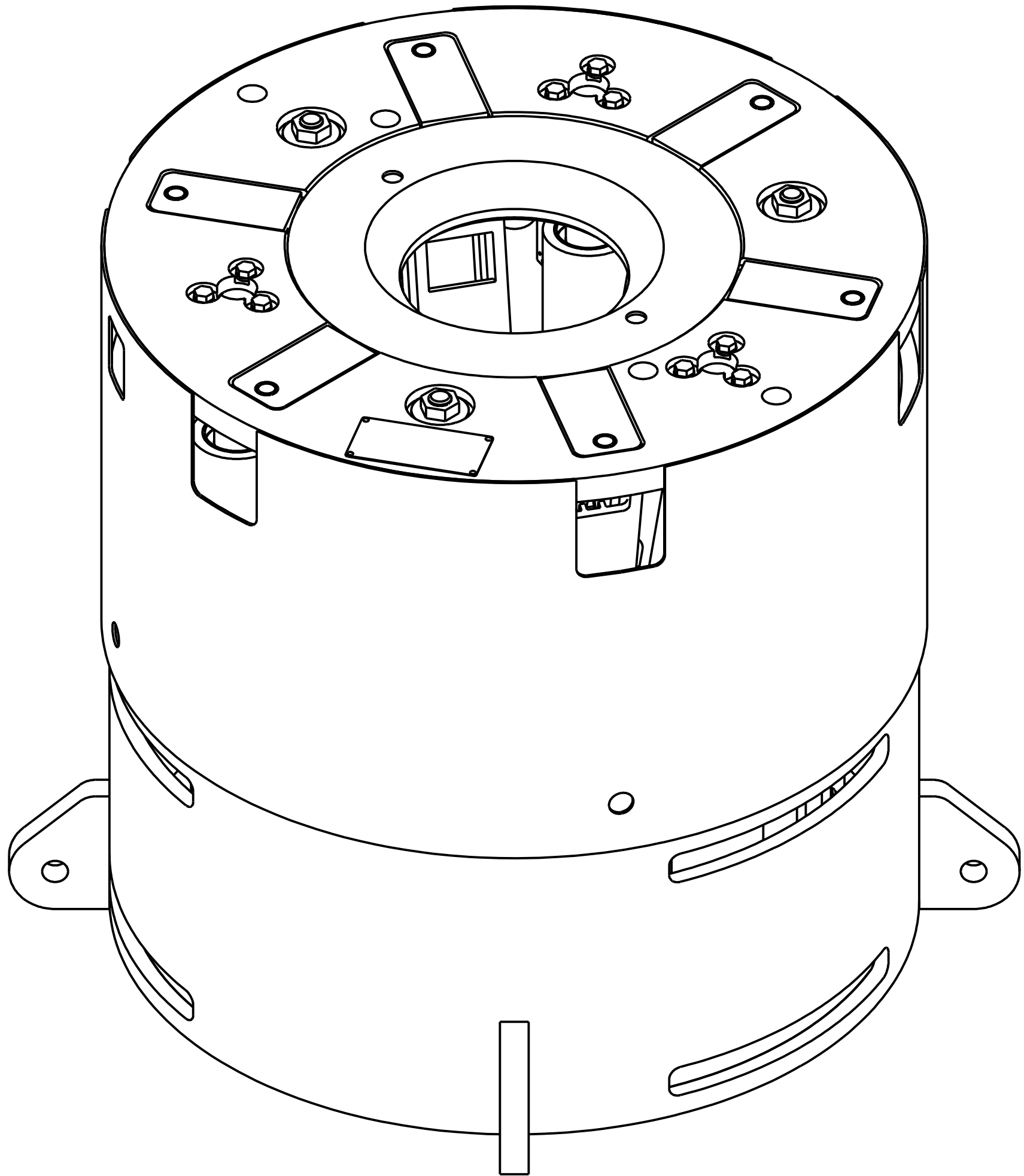
FOR ELECTRICAL CONNECTION INFORMATION, SEE SH 4 AND
SPECIFIC CUSTOMER AUX INTERCONNECTION DIAGRAM

MOUNTING LOCATION DETERMINED BY OTHERS
(MUST HAVE DIRECT SIGHT OF FOXHOLE)

SCALE:	1/8	PROJECTION:		SIZE:	D	SHT:	5 OF 5
DWG NO.	121765	REV:	M.02				

DRAWN IN ACAD
RS-MECH_D-TPL-001

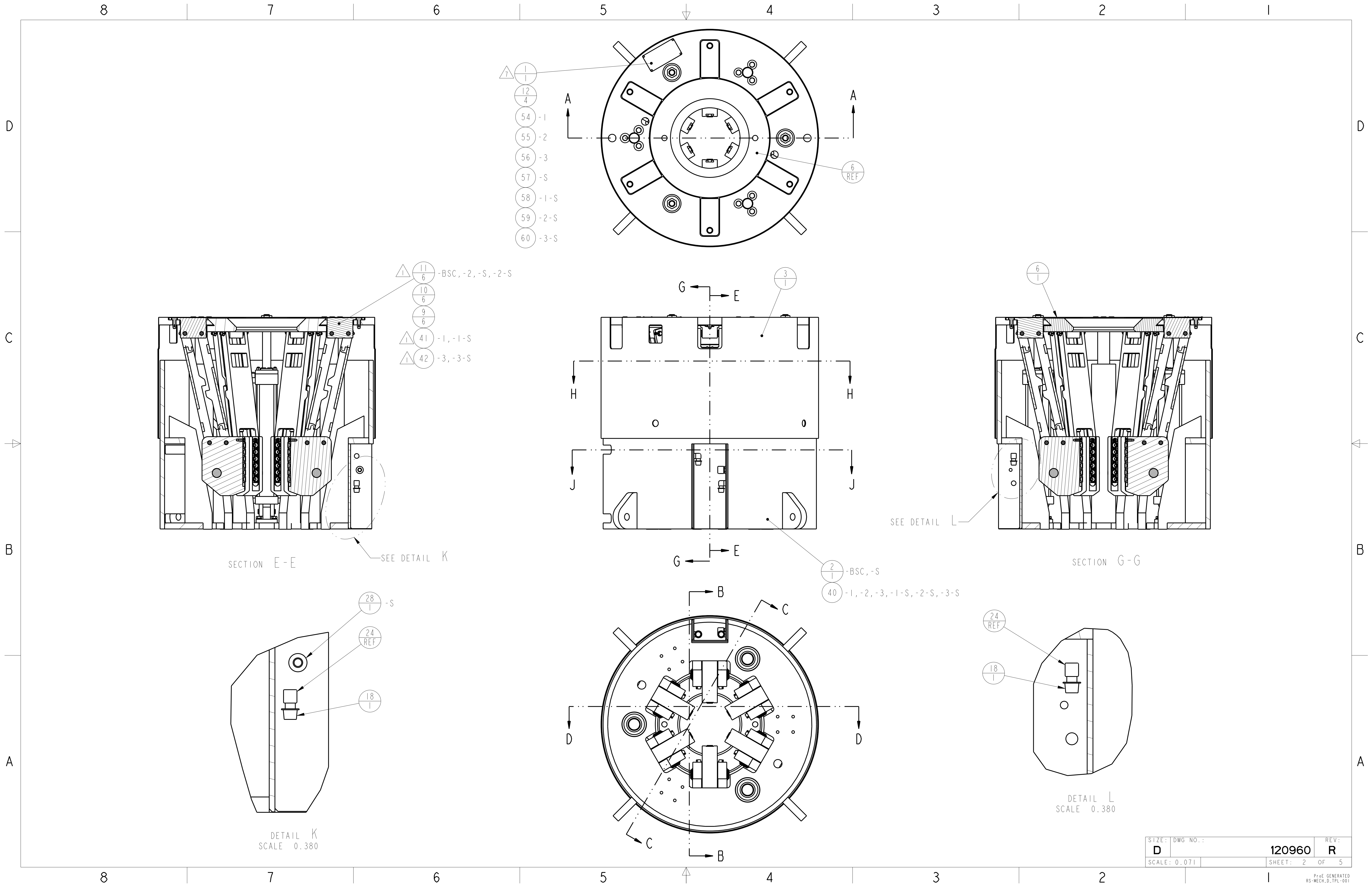
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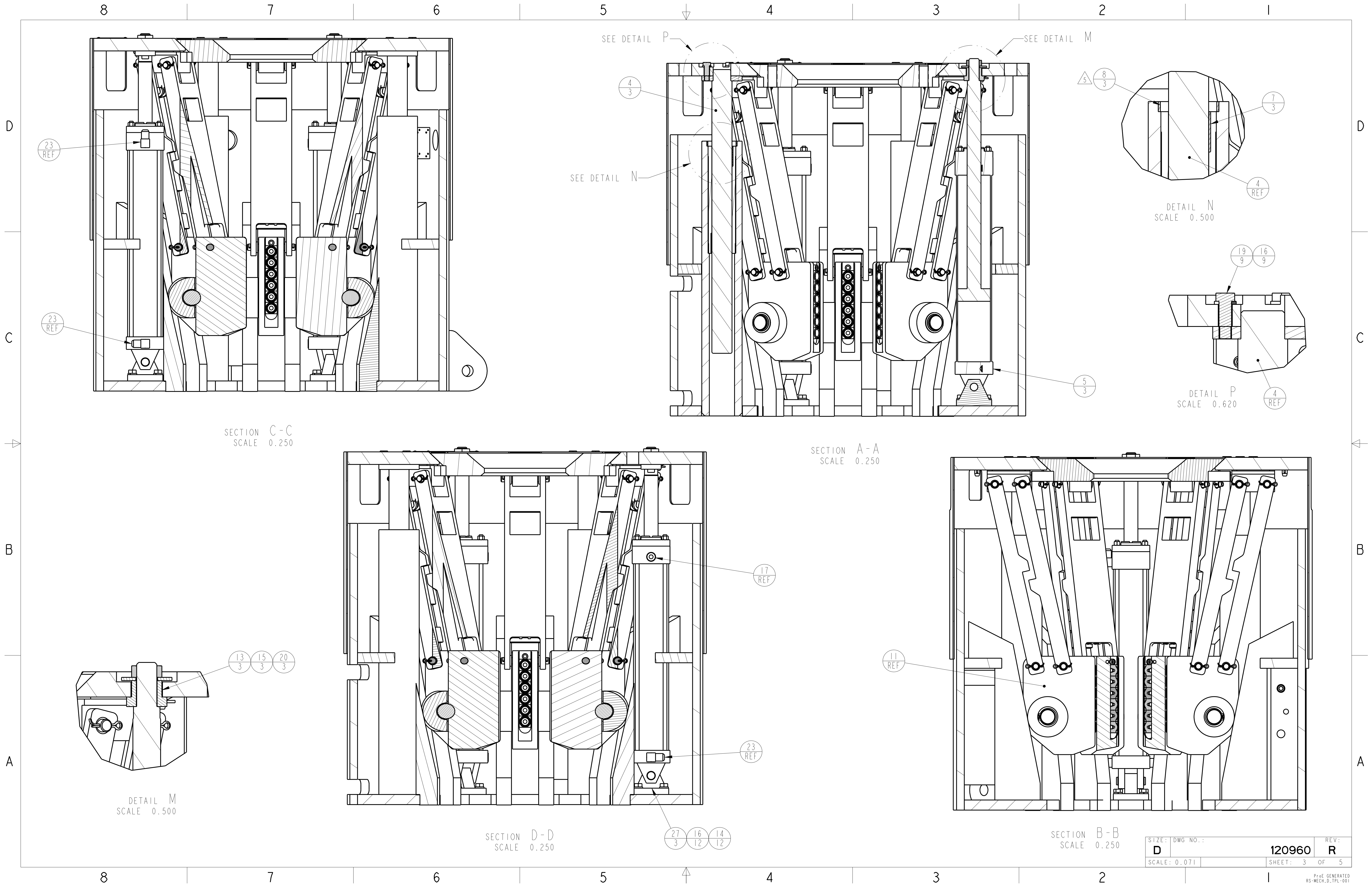


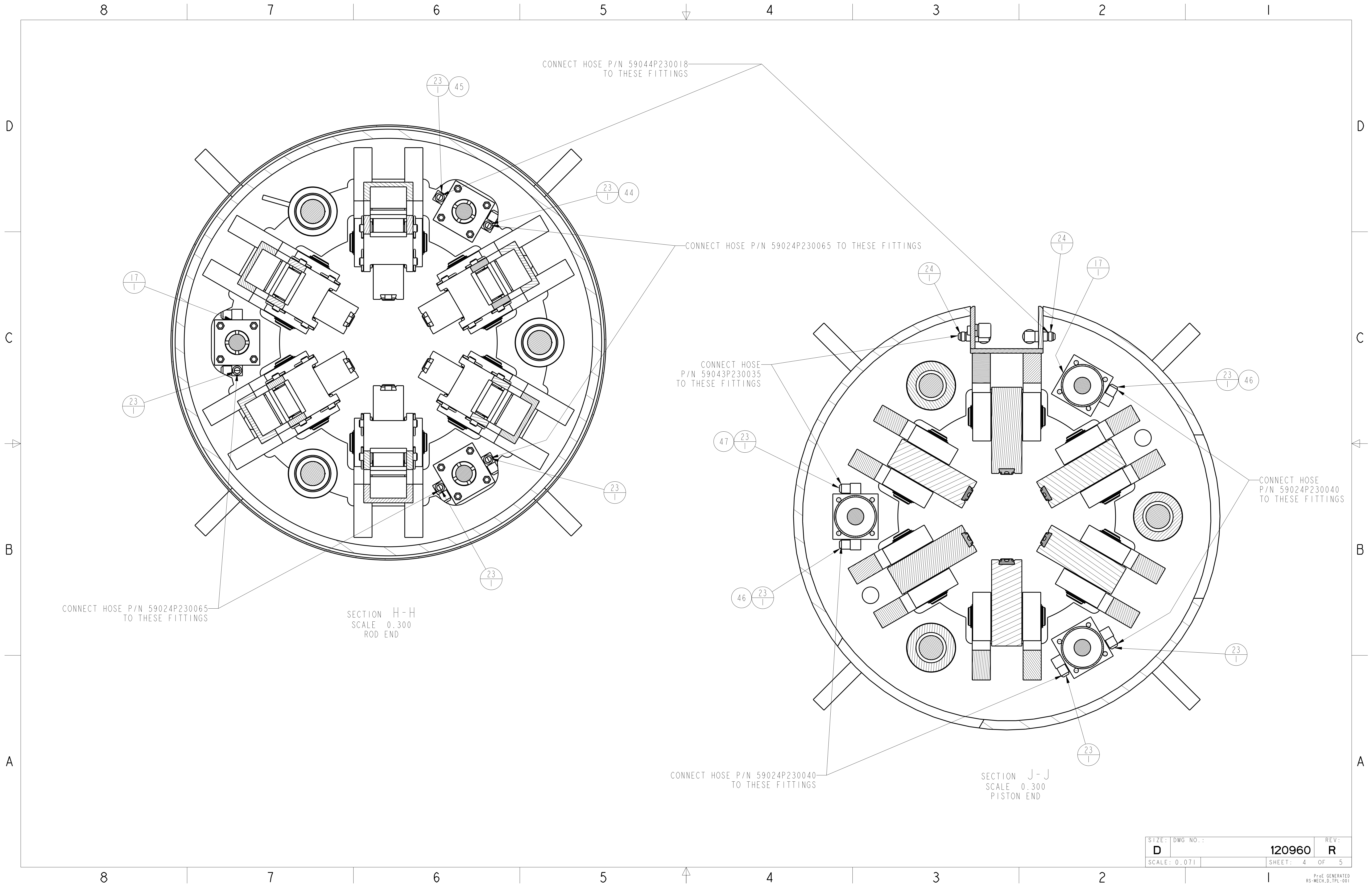
- NOTES - UNLESS OTHERWISE SPECIFIED:
- 1 THIS ASSEMBLY AS SHOWN (-BSC AND -2 CONFIG) IS DRESSED FOR RUNNING PIPE FROM 5" TO 9-3/4" O.D. FOR OTHER PIPE SIZES USE -1 OR -3 CONFIGURATION. FOR PROXIMITY SENSOR USE -S CONFIGURATIONS.
 - 2. FOR ONE YEAR SPARES PARTS LIST REFER TO NOV DRAWING 122746.
 - 3. REFERENCE INSTALLATION KIT DRAWING 121765.
 - 4. TEST PER TS00331
 - 5 ORIENT SEAL SO THAT P/N (INDICATION) IS ON TOP TO KEEP DEBRIS OUT OF BEARING HOUSE.
 - 6 TRACEABILITY REQUIRED.
 - 7 LOCATE THE NAMEPLATE APPROXIMATELY AS SHOWN AND MATCH DRILL MOUNTING PATTERN USING #31 DRILL.

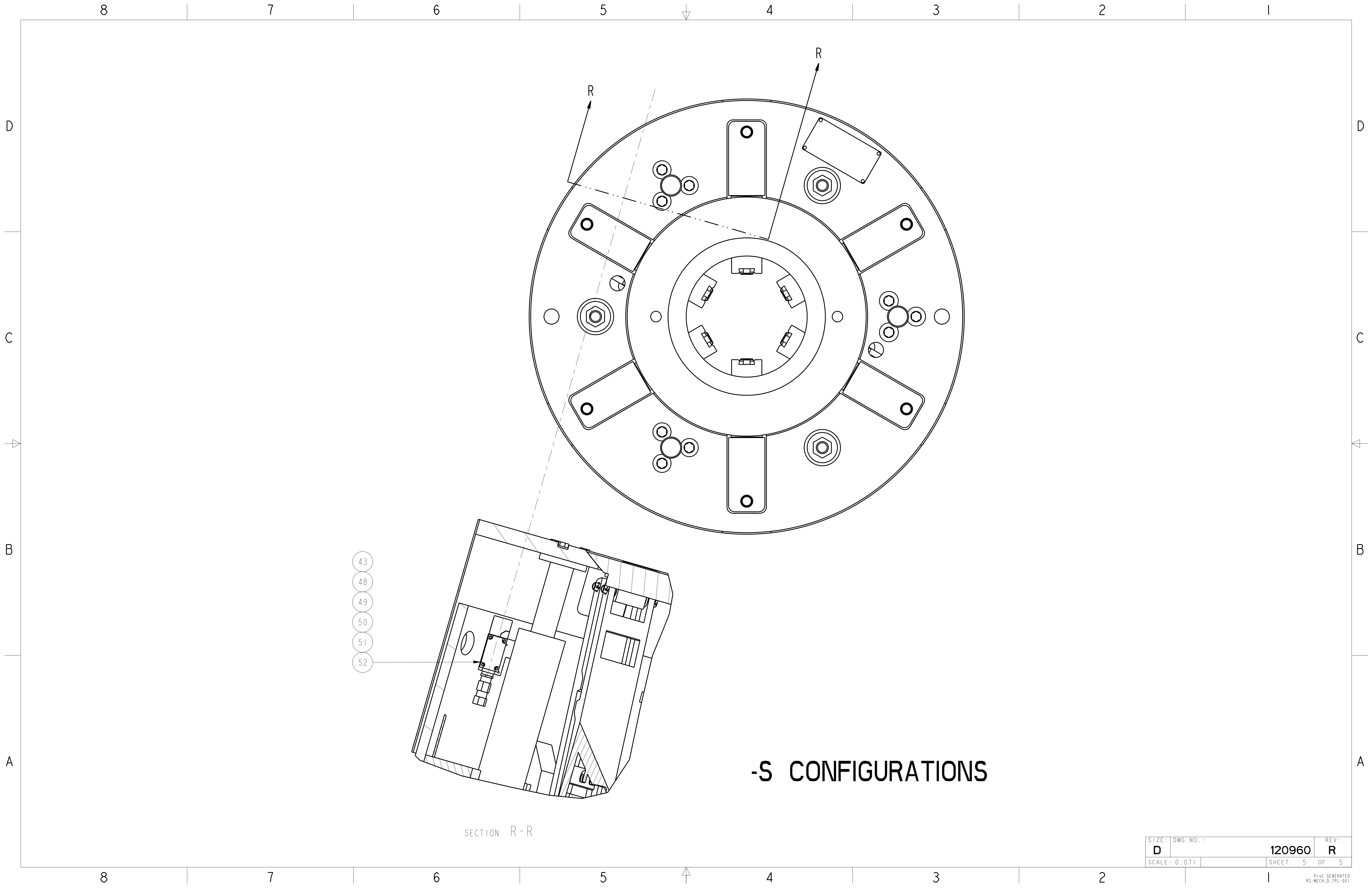
	1	1	1	1	1	1	1	1	1	122499-DWG	PNEUMATIC SCHEMATIC, FSA	61
	1	-	-	-	-	-	-	-	-	10727167-008	NAMEPLATE, FSA	60
	-	1	-	-	-	-	-	-	-	10727167-007	NAMEPLATE, FSA	59
	-	-	1	-	-	-	-	-	-	10727167-006	NAMEPLATE, FSA	58
	-	-	-	1	-	-	-	-	-	10727167-005	NAMEPLATE, FSA	57
	-	-	-	-	1	-	-	-	-	10727167-004	NAMEPLATE, FSA	56
	-	-	-	-	-	1	-	-	-	10727167-003	NAMEPLATE, FSA	55
	-	-	-	-	-	-	1	-	-	10727167-002	NAMEPLATE, FSA	54
												53
	4	4	4	4	-	-	-	-	-	-	50002-12-C5	SCREW, CAP-HEX HEAD
4	4	4	4	-	-	-	-	-	-	50802-N-C	WASHER, FLAT	51
4	4	4	4	-	-	-	-	-	-	50902-C	WASHER, LOCK	50
1	1	1	1	-	-	-	-	-	-	30177196-10	CABLE ASSEMBLY, CONNECTOR O.D.	49
1	1	1	1	-	-	-	-	-	-	M614002913-04	GLAND-CABLE, 1/2" NPT, ARMORED	48
1	1	1	1	1	1	1	1	1	1	59543P230035	HOSE ASSEMBLY	47
2	2	2	2	2	2	2	2	2	2	59524P230040	HOSE ASSEMBLY	46
1	1	1	1	1	1	1	1	1	1	59544P230018	HOSE ASSEMBLY	45
2	2	2	2	2	2	2	2	2	2	59524P230065	HOSE ASSEMBLY	44
1	1	1	1	-	-	-	-	-	-	96388	PROXIMITY SENSOR	43
6	-	-	-	6	-	-	-	-	-	121654-2	SLIP ASSEMBLY (9-5/8" TO 14" PIPE)	42
6	-	-	6	-	-	-	6	-	-	121654-3	SLIP ASSEMBLY (3-1/2" TO 8-1/4" PIPE)	41
1	1	1	-	1	1	1	-	-	-	120958-500	BODY WELDMENT	40
1	1	1	1	-	-	-	-	-	-	56608-04	CONNECTOR, CABLE	28
3	3	3	3	3	3	3	3	3	3	70858	PLATE, MOUNTING-TILT CYLINDER	27
2	2	2	2	2	2	2	2	2	2	56522-8-8-S	ELBOW, 90 BULKHEAD 37/37	24
10	10	10	10	10	10	10	10	10	10	56506-8-8-S	ELBOW, 90° EXT PIPE/37°	23
3	3	3	3	3	3	3	3	3	3	55317-C	NUT, HEX JAM (UNF-2B)	20
9	9	9	9	9	9	9	9	9	9	55008-12-S	SCREW, CAP-HEX HEAD	19
2	2	2	2	2	2	2	2	2	2	53410	PLUG, PLASTIC, PIPE CLOSURE	18
2	2	2	2	2	2	2	2	2	2	53000-08-C	PLUG, EXTERNAL PIPE	17
21	21	21	21	21	21	21	21	21	21	50908-S	WASHER, LOCK-REGULAR, 1/2	16
3	3	3	3	3	3	3	3	3	3	50816-R-C	WASHER, FLAT, 1	15
12	12	12	12	12	12	12	12	12	12	50008-12-S	SCREW, CAP-HEX, .50 UNC X 1.50	14
3	3	3	3	3	3	3	3	3	3	30121200	BUSHING, CYLINDER EXTENSION	13
4	4	4	4	4	4	4	4	4	4	53301-6-6-SS	SCREW, DRIVE - TYPE U	12
6	-	6	-	6	-	6	-	6	-	121654-1	SLIP AND HANGER ASSY	11
6	6	6	6	6	6	6	6	6	6	30121461	COTTER, HAIRPIN	10
6	6	6	6	6	6	6	6	6	6	121460	PIN, HANGER BRACKET	9
3	3	3	3	3	3	3	3	3	3	121157	SEAL, SPRING LOADED	8
3	3	3	3	3	3	3	3	3	3	120969	BUSHING, GUIDE PIN	7
1	1	1	1	1	1	1	1	1	1	120968	GUIDE, PIPE CENTRALIZER	6
3	3	3	3	3	3	3	3	3	3	120964	CYLINDER, AIR, HEAVY DUTY	5
3	3	3	3	3	3	3	3	3	3	120963	ROD, LEVELING BEAM GUIDE	4
1	1	1	1	1	1	1	1	1	1	120959	LEVELING BEAM	3
-	-	-	-	1	-	-	-	1	-	120958	BODY WELDMENT & MACHINING	2
-	-	-	-	-	-	-	-	1	-	10727167-001	NAMEPLATE, FSA	1
-3-S	-2-S	-1-S	-S	-3	-2	-1	-BSC	PART NO.		DESCRIPTION		ITEM NO.

PRODUCT: FSA		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		THIS DOCUMENT CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH BELONGS TO NATIONAL OILWELL VARCO, L.P., ITS AFFILIATES OR SUBSIDIARIES (ALL COLLECTIVELY REFERRED TO HEREINAFTER AS "NOV"). IT IS LOANED FOR LIMITED PURPOSES ONLY AND REMAINS THE PROPERTY OF NOV. REPRODUCTION, IN WHOLE OR IN PART, OR USE OF THIS DESIGN OR DISTRIBUTION OF THIS INFORMATION TO OTHERS IS NOT PERMITTED WITHOUT THE EXPRESS WRITTEN CONSENT OF NOV. THIS DOCUMENT IS TO BE RETURNED TO NOV UPON REQUEST OR UPON COMPLETION OF THE USE FOR WHICH IT WAS LOANED. THIS DOCUMENT AND THE INFORMATION CONTAINED AND REPRESENTED HEREIN IS THE COPYRIGHTED PROPERTY OF NOV.	
END ITEM:		TOLERANCES ARE:			
NEXT ASSY:	121765	X.X ± .1		ANGLES ±1/2 DEG	
SIMILAR TO:		X.XX ± .03		FRACTIONS ± 1/16	
WT LBS:	2,600	X.XXX ± .010		BREAK EDGES .02/.03	
FINISH		DO NOT SCALE DRAWING			
UNLESS OTHERWISE SPECIFIED TOL < ±.06 250		CHECKED	B. MEISCH	INITIAL	
TOL ≥ ±.06 1000		APPVD	V. LIUZZI	J. BERRY	
✓		DATE	1/28/16	L. WELLS	
				RIG SOLUTIONS ENGINEERING	
				SCALE: 0.071	
				PROJECTION:	
				SIZE: D	
				SHEET: 1 of 5	
				DWG NO.: 120960	
				REV: R	









-S CONFIGURATIONS

SECTION R-R

SIZE: D	DWG NO.: 120960	REV: R
SCALE: 0.071	SHEET: 5	OF 5

D

C

B

A

NOTES: UNLESS OTHERWISE SPECIFIED:

1. REF. PNEUMATIC SCHEMATIC DWG. No. 96377 (BSC, -1 & -3 CONFIGURATION) OR 111348 (-2 & -4 CONFIGURATION), OR 122499 FOR -6
2. DELETED
3. STAMP VARCO ASSEMBLY PART No. (ASSY 96403-X) INDICATING CONFIGURATION APPROXIMATELY WHERE SHOWN.
4. PAINT PER VARCO SPEC. VPS00001, COLOR: RED.
5. BSC, -2, -3 & -4 CONFIGURATIONS FOR EUROPEAN VERSION. -1 CONFIGURATION FOR CANADIAN VERSION.
6. .500 O.D. x .049 WALL TUBING, MATL: 316 ST.STL. PER MS0034
7. REVERSE ORIENTATION OF SOLENOID AND BIAS SPRING ASSEMBLY (-2 AND -4 ONLY).
8. -5 & -6 CONFIG SAME AS -2 EXCEPT AS SHOWN (SEE SHEET 3)
9. -6 CONFIG USED ON FOXHOLE SPIDER
10. TUBE ASSEMBLIES TO BE FITTED AT TIME OF ASSEMBLY
11. CONFIG -7 SIMILAR TO -4 CONFIG., EXCEPT ITEMS 45, 46, AND 62.
12. NOTE THE ORIENTATION OF THE QUICK DISCONNECTS.

10
10
10

-	1	-	-	-	-	-	-	112575-4	J-BOX, STB 1 (NON-IS)		72
-	2	-	-	-	-	-	-	53410	CAP, PLASTIC		71
-	-	3	3	3	3	3	3	50804-R-S	WASHER, FLAT		70
-	-	3	3	3	3	3	3	50904-S	WASHER, LOCK-REGULAR		69
-	-	3	3	3	3	3	3	50004-6-S	SCREW, CAP-HEX HEAD (UNC-2A)		68
-	1	-	-	-	-	-	-	56501-8-8-S	CONNECTOR, EXT PIPE 37"		67
-	-	-	-	-	-	-	-		DELETED		66
-	-	-	-	-	-	-	-		DELETED		65
-	-	-	-	-	-	-	-		DELETED		64
-	1	-	-	-	-	-	-	97787-8-FFG	VALVE, NEEDLE		63
1	-	-	-	1	-	-	-	53001-08-C	PLUG, EXT PIPE - HEX HEAD		62
-	1	-	-	-	-	-	-	56702-8-8-S	ELBOW, 90 DEG. EXT PIPE		61
2	7	2	2	2	2	2	2	56506-8-8-S	ELBOW, 90 DEG. EXT PIPE/37		60
-	2	-	-	-	-	-	-	56162-8-8-S	TEE, PIPE-EXT/INT/INT		59
-	1	-	-	-	-	-	-	TBD	TUBE ASSEMBLY (1/2")	DELETE	58
-	1	-	-	-	-	-	-	TBD	TUBE ASSEMBLY (1/2")		57
-	1	-	-	-	-	-	-	105955-800-B	CHECK VALVE		56
-	1	-	-	-	-	-	-	TBD	TUBE ASSEMBLY (1/2")		55
-	2	2	-	-	2	2	2	56703-8-8-S	NIPPLE, PIPE (1/2" NPT, EXT)		54
-	1	-	-	-	-	-	-	88549	REGULATOR		53
-	-	1	-	-	-	-	-	112575-1	J-BOX, STB 1 (NON-IS)		52
-	1	1	-	-	-	-	-	30112592	VALVE, FOUR-WAY DIRECTION CONTROL SOLENIOD PILOT		51
3	-	3	3	-	3	-	-	50905-S	WASHER, LOCK		50
2	-	2	2	-	2	-	-	50105-8-S	SCREW, CAP-SOCKET HEAD 5/16-18 UNC-2A		49
3	-	3	3	-	3	-	-	55105-8-S	SCREW, CAP-SOCKET HEAD 5/16-24 UNF-2A		48
-7	-6	-5	-4	-3	-2	-1	BSC	PART NO.	DESCRIPTION	MATERIAL	ITEM NO.
QTY REQD											

PRODUCT: PS-16

END ITEM:

NEXT ASSY: 96463

SIMILAR TO:

WT LBS:

FINISH

UNLESS OTHERWISE SPECIFIED
TOL < ±.06
250 ✓

TOL ≥ ±.06
1000 ✓

CHECKED V.LUIZZI

APPVD B.WALLIHAN

DATE 6/27/2014

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.

ANGLES ±1/2 DEG

FRACTIONS ±1/16

BREAK EDGES .02/.03

DO NOT SCALE DRAWING

CURRENT J.McCORMACK

INITIAL R. TOMSIC

10/1991

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RIG SOLUTIONS
MECHANICAL ENGINEERING

TITLE:
ASSY,ELEC.CONT.VLV,PS-16
PLATE ASSY, CONTROL VALVE

SCALE: 1/2

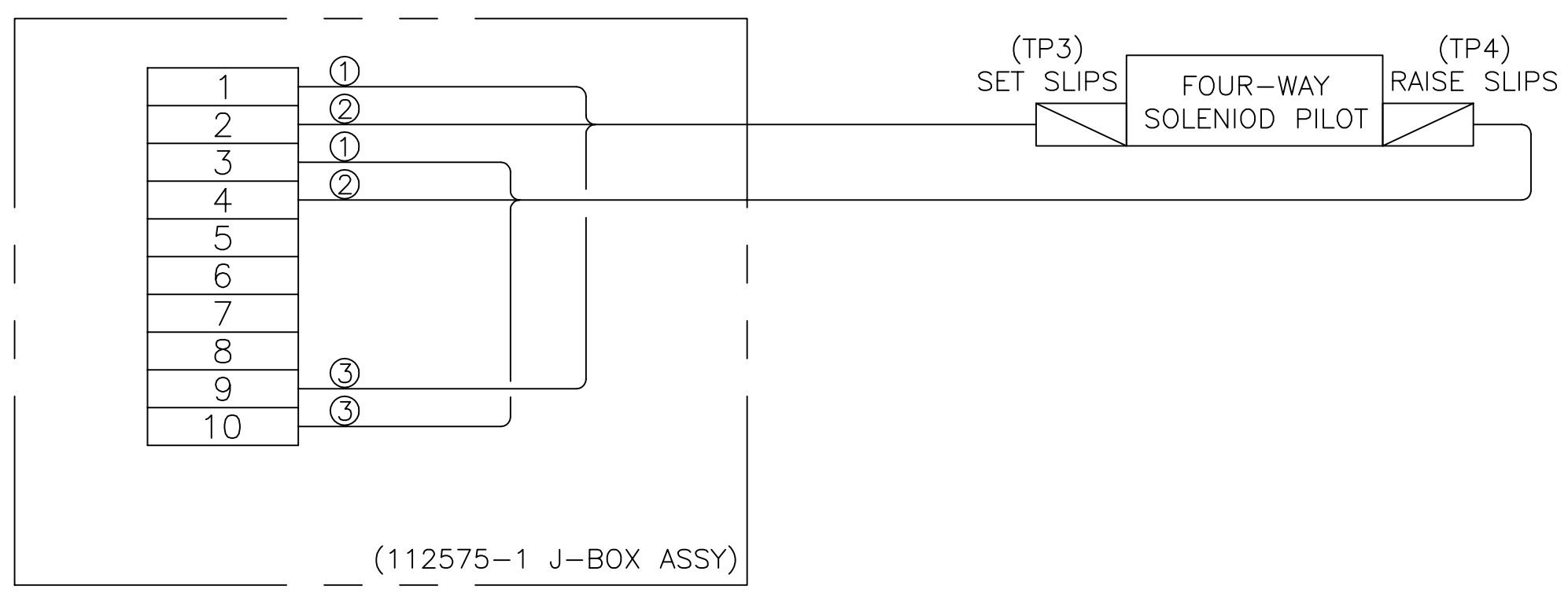
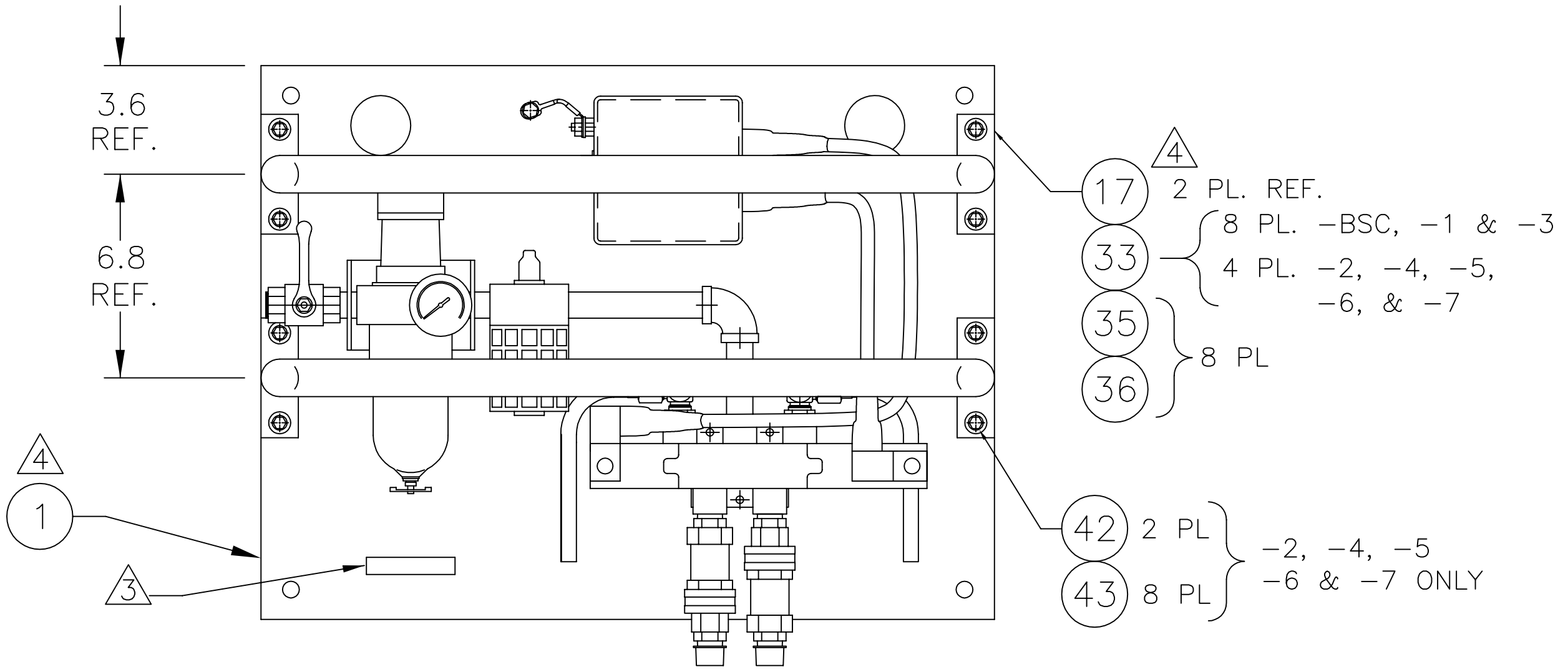
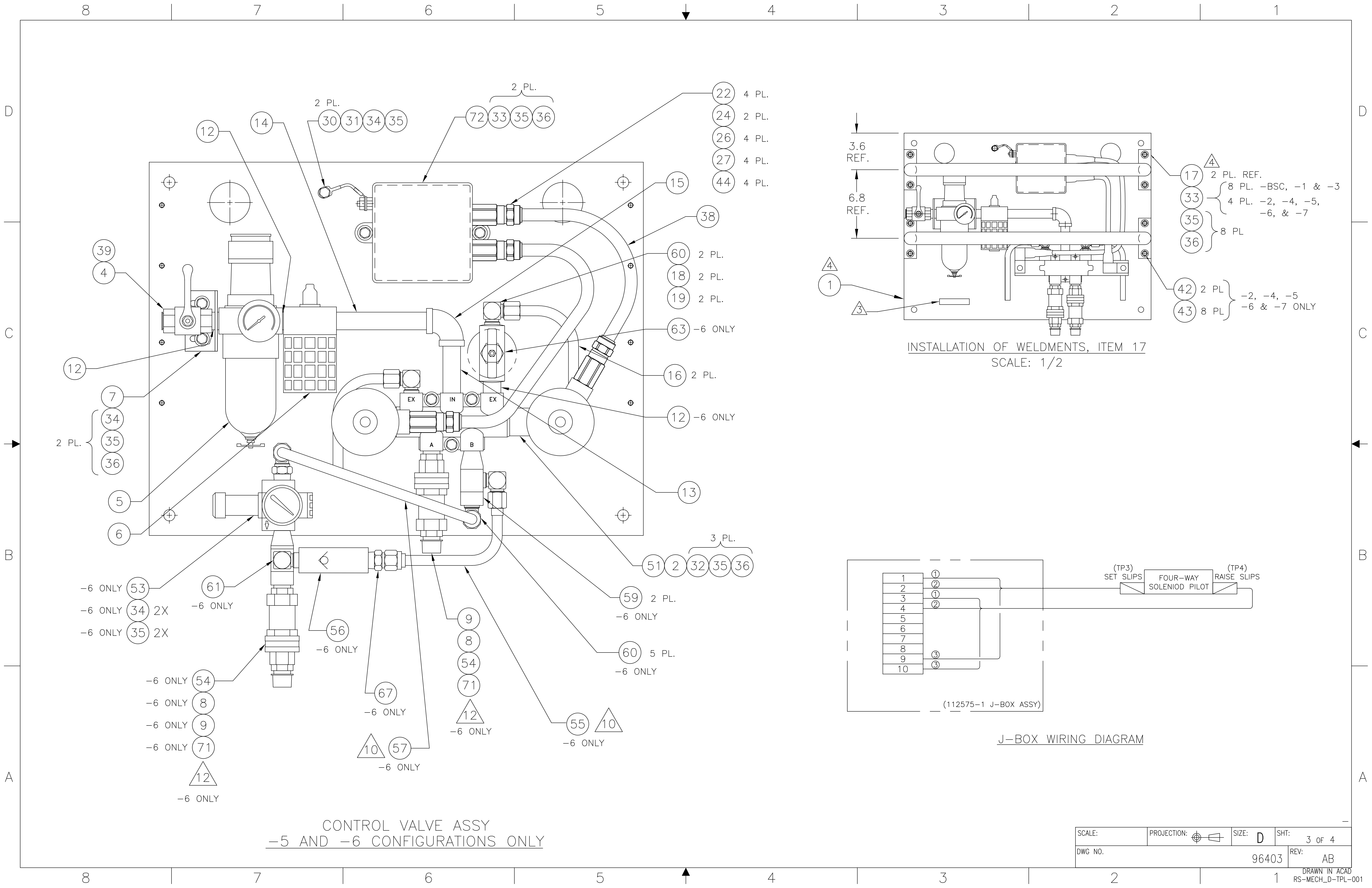
PROJECTION:

SIZE: D

SHT: 1 OF 4

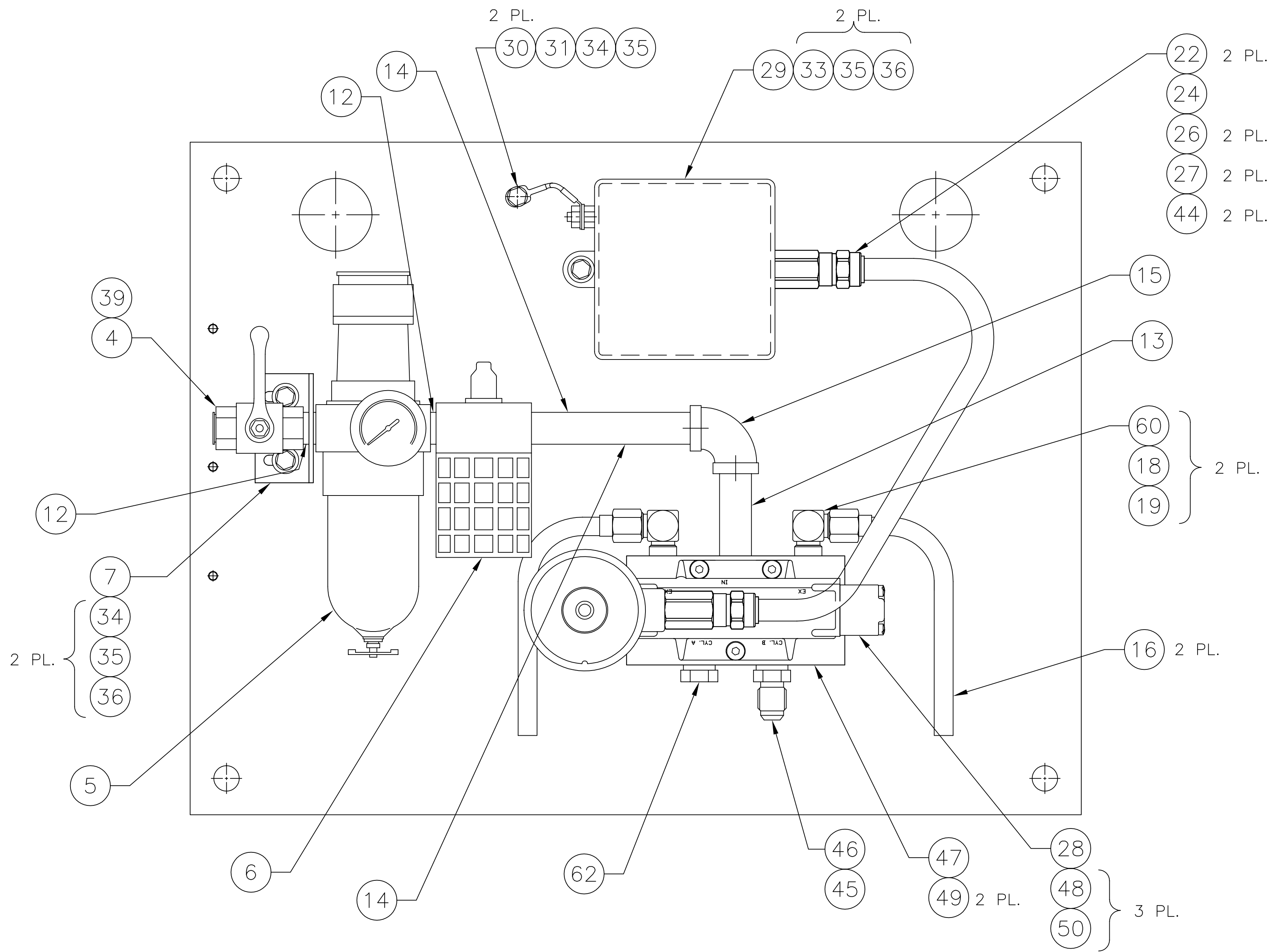
DWG NO. 96403

REV: AB



CONTROL VALVE ASSY
-5 AND -6 CONFIGURATIONS ONLY

J-BOX WIRING DIAGRAM

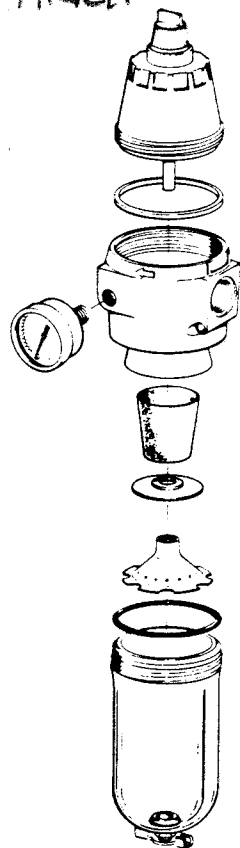


CONTROL VALVE ASSY -7 CONFIGURATION

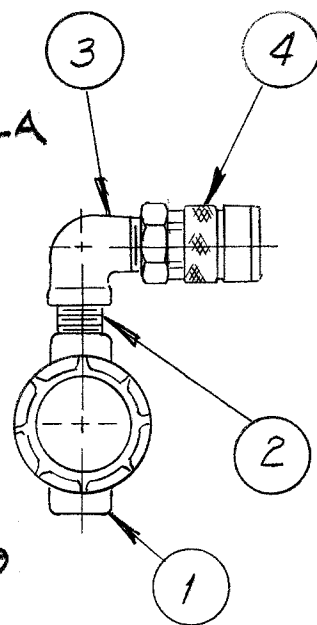
NOTES - UNLESS OTHERWISE SPECIFIED

1. APPROVED SOURCE:
C.A. NORGREN CO. P/N B12-497-M3LA
CONSISTING OF: 1/2" FILTER-REGULATOR ASSY COMPLETE WITH MANUAL DRAIN, 0-160 PSIG GAUGE, 1/2 PINT METAL BOWL w/ SIGHT GLASS AND 50 MICRON FILTER ELEMENT.

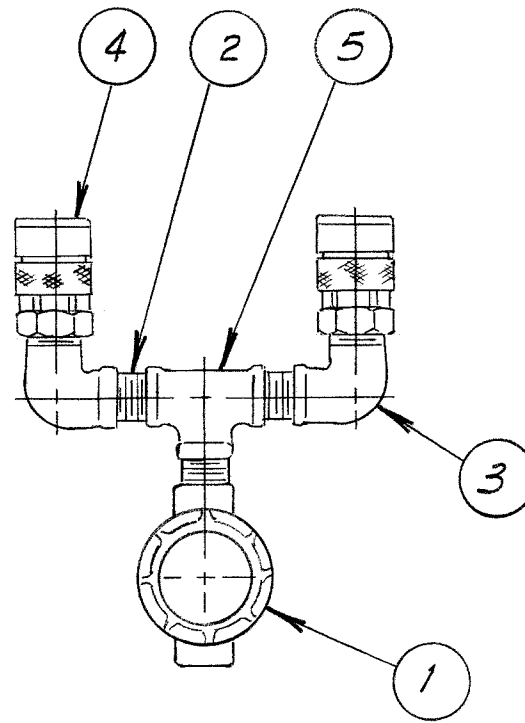
2. APPROVED SOURCE:
C.A. NORGREN CO. P/N 18-013-209
CONSISTING OF: 160 PSI/11 BAR GAUGE, 2 DIA FACE, 1/4 NPT MALE FITTING.



1. 1 REF



-2
CONFIGURATION



-1
CONFIGURATION

1	-	-	-	11883-3	GAUGE	2.	6
-	-	1	-	52708-4	TEE, INT PIPE-COMMON		5
-	1	2	-	7843	COUPLER, QUICK-DISCONNECT		4
-	1	2	-	52408-4	ELBOW, STREET-90° COMMON		3
-	1	3	-	52008-12-G	NIPPLE, PIPE		2
-	1	1	1	11883	FILTER/REGULATOR	1	1
-3	-2	-1	BSC	PART NO.	DESCRIPTION	MATERIAL	ITEM NO.
QTY. REQD.							

-3	99719	PHM
-2	14720	350T SP
-2	11880	350T EL
-1	11881	350T E/S
BASIC	7830-2	500T EL (DL)
BASIC	7830-1	500T E/S (DL)
DASH NO.	NEXT ASSY	USED ON

UNLESS OTHERWISE SPECIFIED

INTERPRET DIMENSIONS & TOLERANCES IAW ANSI Y14.5

DIMENSIONS ARE IN INCHES

TOLERANCES
.X ± .1 .XX ± .03 .XXX ± .010

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LIST OF MATERIAL

DRAWN	J.O. 2-25-77
CHECKED	R.R.R. 12-12-77
ENGR	G.H. 2-25-77
APPROVED	

RELEASE STATUS

- ☒ UNLIMITED
☐ LIMITED
☐ DEVELOPMENT
☐ EXPERIMENTAL

Varco		VARCO INTERNATIONAL, INC. ORANGE, CA. 92668	
TITLE FILTER/REGULATOR			
SIZE B	DRAWING NO. 11883		
SCALE	WEIGHT -1~4LB -2~3LB	SHEET 1 OF 1	

REVISIONS				
LTR	DESCRIPTION	DRAWN	CHECKED	APPD
B	SEE DCN REPLACES 11883 REV 'A'	1-4-78	5-2-78	G.H. 1-5-78
C	SEE DCN	MACDONALD 11-20-80	JVG 12-10-80	DK 12/10/80
D	SEE DCN	PAUL K 1/22/92	1/22/92	
E	SEE DCN	PAUL K 6/28/96		
F	SEE DCN	JRF 1/19/98		

1. TRACEABILITY REQUIRED. STAMP ASSEMBLY WITH "PART NUMBER - LATEST REV", TRACE CODE AND PIPE RANGE SIZE PER VIEW A-A.

2. DELETED.



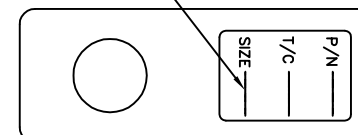
(PER HANGER ASSYM. 6 REQUIRED)

-1 (5" TO 9-3/4")	75 LB.
-------------------	--------

-2 (9-5/8" TO 14")	65 LB.
--------------------	--------

-3 (3-1/2" TO 8-1/4") 85 LB.

5" TO 9-3/4"
9-5/8" TO 14"
3-1/2" TO 8-1/4"



STAMP P/N AND T/C .25 HIGH CHARACTERS,
STAMP PIPE RANGE SIZE .50 HIGH CHARACTERS.

VIEW A-A

8	8	8	121524	FLANGED BUSHING		9
1	1	1	120967	BRACKET, SLIP HANGER		8
2	2	2	121457	SPRING, EXTENSION		7
2	2	2	120962	SLIP HANGER		6
8	8	8	51435-12	PIN, COTTER		5
4	4	4	120966	PIN, HANGER		4
1			121655	SLIP ASSEM. (3-1/2" to 8-1/4")		3
	1		121502	SLIP ASSEM. (9-5/8" to 14")		2
		1	120961	SLIP ASSEM. (5" to 9-3/4")		1

of	DESCRIPTION
LIST OF MATERIAL	

[illegible]

NEW NATIONAL OILWELL VARCO

SLIP AND HANGER
ASSY

SCALE: 1/2	WT LBS: SEE TABLE	PROJECTION: 	SIZE: D	SHEET: 1 of 1
DRAWING NUMBER: 121654			REVISION: E	

PARTS DISPOSITION	USE	REWORK	SCRAP	NOTED	 	SHEET <u>1</u>	DOCUMENT NO.		REVISION
RAW MAT'L	X					OF <u>1</u>	121654		E
IN PROCESS	X					ECN NO.	DOCUMENT TITLE		
COMPLETED	X					85195	SLIP AND HANGER ASSY		
ASSEMBLED	X						PREPARED	CHECKED	APPROVED
DISPOSITION NOTED:					REASON FOR CHANGE (FROM DCR) : 1 ☐ COST REDUCTION/EASE OF MANUFACTURING 2 ☐ BOM CORRECTION 3 ☐ DRAWING CORRECTION 4 ☐ IMPROVED SERVICEABILITY 5 ☐ IMPROVED PERFORMANCE 6 ☐ IMPROVED INSTALLATION 7 ☐ CUSTOMER REQUIREMENT 8 ☒ OTHER: <u>ADDITIONAL VIEW REQUIRED.</u>	D.HIRULKAR		K.MARX	G.TRAEGER

EFFECTIVE DATE 5/26/06

ADDITIONAL DISTRIBUTION TO: ☐ TECH PUBS ☐ SPARES ☐ OTHER: _____

NOTE 1,
IS: TRACEABILITY REQUIRED. STAMP ASSEMBLY WITH "PART NUMBER – LATEST REV",
TRACE CODE AND PIPE RANGE SIZE PER VIEW A–A.
WAS: TAG ASSEMBLY WITH " PART NUMBER – LATEST REV "

NOTE 2, DELETED, WAS, TRACEABILITY REQUIRED.

ZONE B2, ADDED VIEW A–A.
ZONE C3, ADDED SIZE TABLE.

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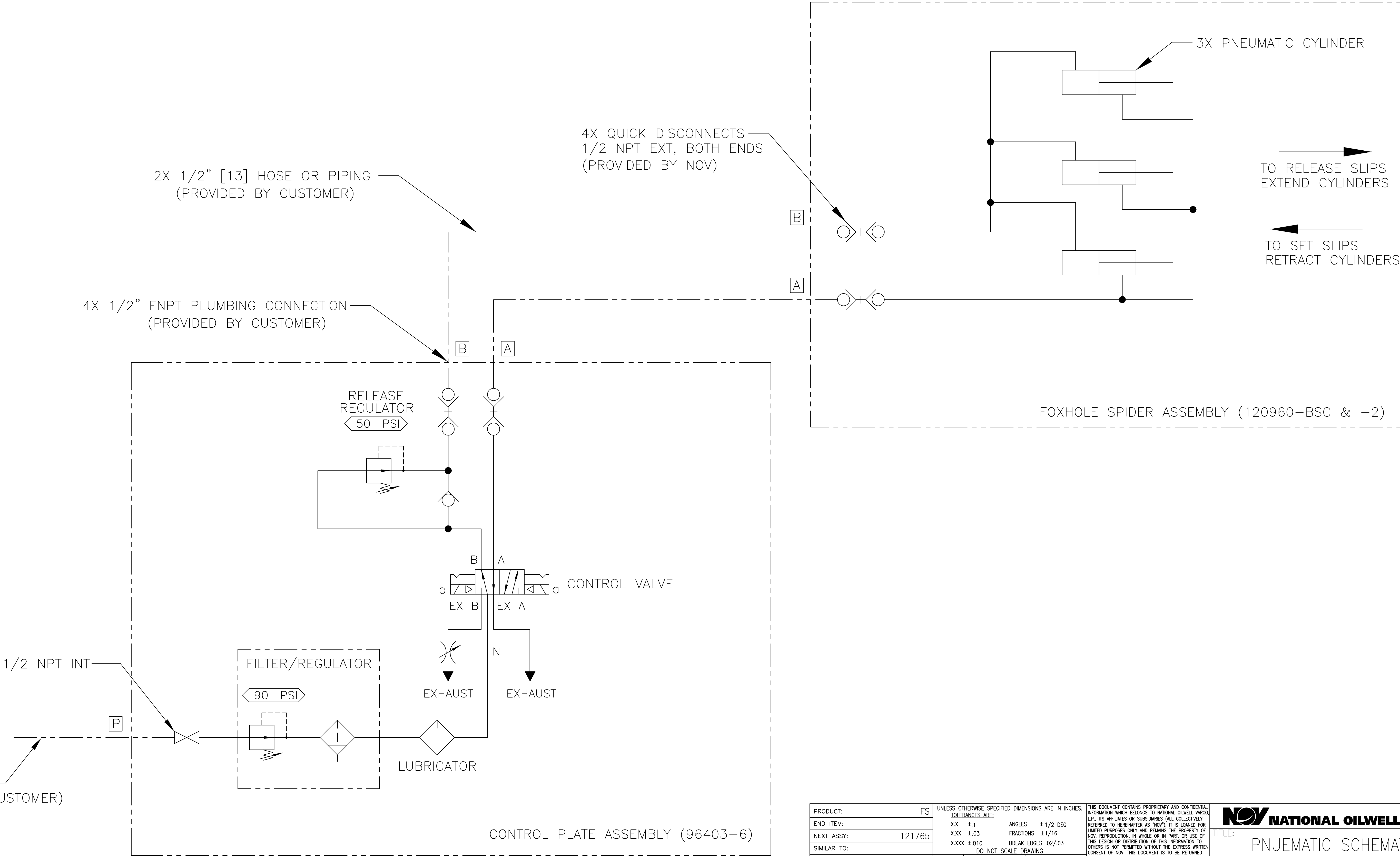
Revision: 01

Page: 1

Vol.	Chapter/ Section	Title	Document Number	Rev.
1	3.2	System/Process Diagrams		
		Pneumatic Schematic Foxhole Spider	122499	E

NOTES: UNLESS OTHERWISE SPECIFIED

1. REFERENCE FOXHOLE SPIDER INSTALLATION KIT 121765



PRODUCT: FS		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE:		THIS DOCUMENT CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH BELONGS TO NATIONAL OILWELL VARCO, L.P., ITS AFFILIATES OR SUBSIDIARIES (ALL COLLECTIVELY REFERRED TO HEREINAFTER AS "NOV"). IT IS LOANED FOR LIMITED PURPOSES ONLY AND REMAINS THE PROPERTY OF NOV. REPRODUCTION, IN WHOLE OR IN PART, OR USE OF THIS DESIGN OR DISTRIBUTION OF THIS INFORMATION TO OTHERS IS NOT PERMITTED WITHOUT THE EXPRESS WRITTEN CONSENT OF NOV. THIS DOCUMENT IS TO BE RETURNED TO NOV UPON REQUEST OR UPON COMPLETION OF THE USE FOR WHICH IT WAS LOANED. THIS DOCUMENT AND THE INFORMATION CONTAINED AND REPRESENTED HEREIN IS THE COPYRIGHTED PROPERTY OF NOV.	
END ITEM:		X.X ±.1	ANGLES ±1/2 DEG		
NEXT ASSY: 121765		X.XX ±.03	FRACTIONS ±1/16		
SIMILAR TO:		X.XXX ±.010	BREAK EDGES .02/.03		
WT LBS:		DO NOT SCALE DRAWING			
FINISH		CURRENT	INITIAL	RIG SOLUTIONS MECHANICAL ENGINEERING	
UNLESS OTHERWISE SPECIFIED TOL < ±.06 TOL ≥ ±.06		DRAWN	V.LIUZZI W. WINSLOW		
250 ✓ 1000 ✓		CHECKED	T. MONTGOMERY C. SWIONTEK		
		APPVD	T. MONTGOMERY W. WINSLOW		
		DATE	12/20/12 9/97		
TITLE:				SCALE: NONE	
PNUEMATIC SCHEMATIC FOXHOLE SPIDER				PROJECTION: 	
				SIZE: D	
				SHT: 1 OF 1	
				DWG NO. 122499	
				REV: E	

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Revision: 01

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Vol.	Chapter/ Section	Title	Document Number	Rev.
1	3.3	Electrical/Instrument <i>Remarks: Section Not Applicable</i>		

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Revision: 01

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Vol.	Chapter/ Section	Title	Document Number	Rev.
1	3.4	Performance Data <i>Remarks: Section Not Applicable</i>		

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Revision: 01

Page: 1

Vol.	Chapter/ Section	Title	Document Number	Rev.
4	4	Vendor Documentation <i>Remarks: Chapter Not Applicable</i>		

National Oilwell Varco Brands

Advanced Wirecloth	Mission
Aktro	Molde
Alberta Instrument	Mono
Albin's Enterprises	Monoflo
AmClyde	National
Baylor	National Oilwell
Best Flow Products	Norson
BLM	Oil Tools Solutions
Bowen	Oilwell
Brandt	Omega Pumps
Cabot	Pacific Inspection
Cardwell	PCE
Chimo Equipment	Peck-O-Matic
Continental Emsco	PEP
Cooper	Procon As
Crestex	Quality Tubing
Custom Die & Insert	Rebound Rig
DELCO	Retsco
Dreco	RMI (Rig Manufacturing International)
DSS (Drilling Support Services)	Roberts Johnson
Eastern Oil Tools	ROSS HILL
Elmar	Rucker
EMD (Electro Motive Division)	Russell Subservice
Fibercast	Sauerman
Fidmash	Shaffer
Flanagan Ironworks	Shearer
Franks	Skytop Brewster
Gardner Denver (Hoisting)	Smith Fiberglass
Gator Hawk	Specialty
Gregory	SSR
Griffith	Stålprodukter
HALCO	Star Fiberglass
Harrisburg	Tech Power
Hepburn	TEM (Tulsa Equipment Manufacturing)
HITEC	Texas Oil Tools
Houston Scientific	TS&M
Hydra Rig	Tuboscope
Ideco	Turner Oilfield Service
IPS (Integrated Power Systems)	UNIFLEX
IRI International	Unit (Cranes)
Koomey	Universal
Kremco	USF (Utility Steel Fabricators)
LOIS ALLIS	Varco
Lucker	Vector
M & W	Versatech
M/D Totco	Western Oilfield Engineering
Mathey	Wheatley Gaso
MATTCO	Wildcat Services
McElroy Marine Machinery	Wilson
Miller Oilfield	Woolley

Downhole Solutions

Drilling Solutions

Engineering and Project Management Solutions

Lifting and Handling Solutions

Production Solutions

Supply Chain Solutions

Tubular and Corrosion Control Solutions

Well Service and Completion Solutions

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