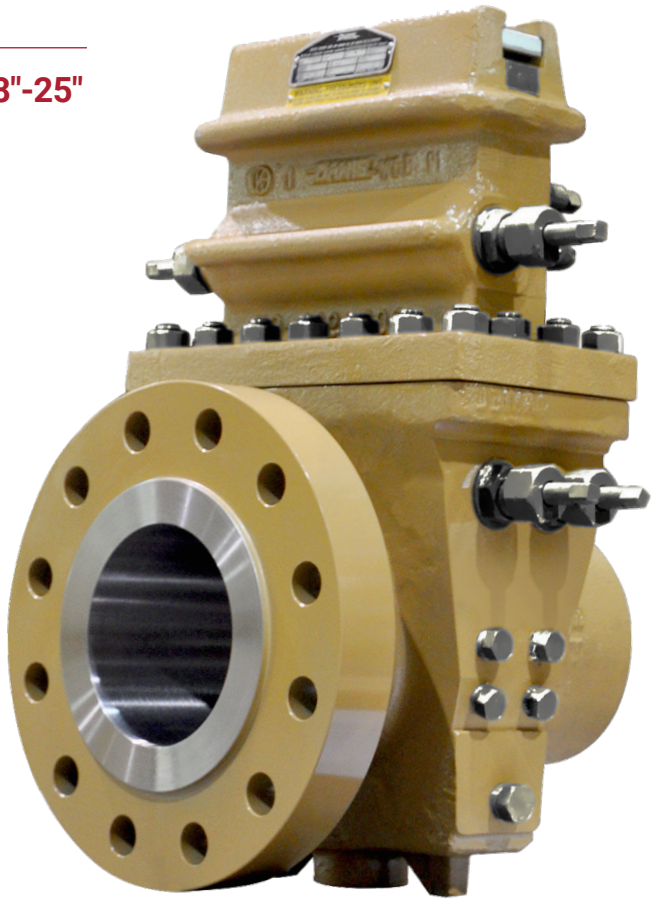
DANIEL®
SENIOR ORIFICE FITTING
USER MANUAL

DANIEL SENIOR ORIFICE FITTING 18"-25"
150-600



OCTOBER 2022

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Part I
Plan

1 Introduction

1.1 Definition of Acronyms

Table 1-1: Acronyms and their definition

Acronym	Description
AGA	American Gas Association
AISI	American Iron and Steel Institute
API	American Petroleum Institute
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
GPA	Gas Processors Association
ISO	International Organization of Standardization
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry, Inc
NACE	NACE International (formerly National Association of Corrosion Engineers)
MPMS	API Manual of Petroleum Measurement Standards
API-14.3	API-AGA joint flow measurement code (API MPMS Chapter 14, Section 3, Part 2:2000(R2011) - also AGA Report No. 3, Part 2 and GPA 8185-00, Part 2)
ISO 5167	ISO flow measurement code (ISO 5167-2:2003(E))
U/S	upstream
D/S	downstream
DP	differential pressure (ΔP) - differences of static pressures found on the U/S and D/S faces of an orifice plate during the flow measurement process
CRS	cold rolled steel
CS	carbon steel
SS	stainless steel
YP	gold (yellow chromate) zinc plated
ZP	silver (clear chromate) zinc plated
MAOP	maximum allowable operating pressure
NPSM	national pipe straight mechanical thread
NPT	national pipe tapered thread
HBR	butadiene rubber

Table 1-1: Acronyms and their definition *(continued)*

Acronym	Description
HNBR	hydrogenated nitrile-butadiene rubber
NBR	nitrile-butadiene rubber
FFKM	perfluoroelastomer rubber
FKM	fluoroelastomer rubber
PTFE	polytetrafluoroethylene
SBR	styrene-butadiene rubber
TFE	tetrafluoroehtylene

1.2 Purpose of this manual

This manual provides guidance to owners and personnel in the installation, operation and maintenance of the *Daniel™ Senior™ Orifice Fitting*.

To ensure safe and proper installation, operation and maintenance, it is imperative that product owners and operation personnel read and follow the information contained in this manual.

1.3 Product description

The Daniel Senior Orifice Fitting is an orifice plate holding device that houses, and accurately positions, an orifice plate within a pipe or tube to measure fluid flow. It is one component of a flow measurement system. The Senior Orifice Fitting (Senior) is designed to:

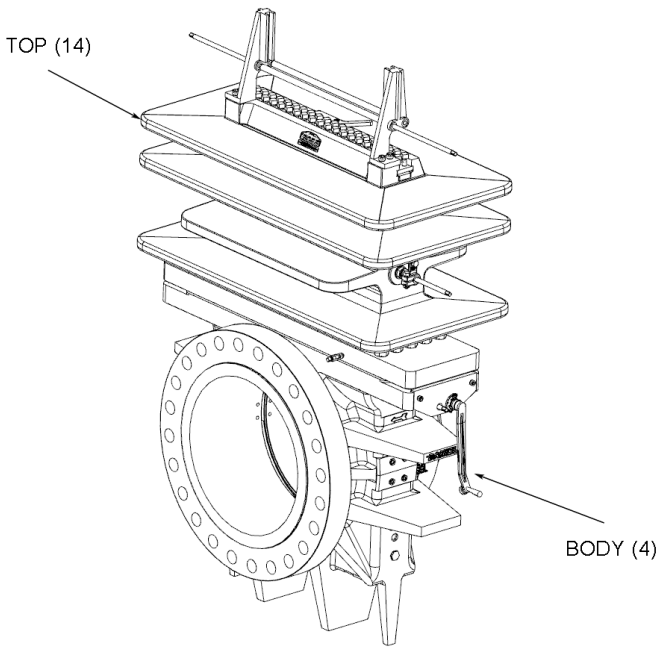
- Position an orifice plate, concentric to flow moving through a pipeline, within API -14.3, Part 2 or ISO 5167 installation requirements.
- Allow personnel to remove and replace an orifice plate without disturbing the flow measurement system piping, with little, or no, interruption in service and without removing the Senior from the system.

The orifice plate within a Senior restricts the fluid moving through a pipe. This restriction creates a change in static pipe pressure of the fluid. Instrumentation measure the difference in change of the fluid entering orifice plate bore, and once again after it exits the plate bore. This instrumentation then combines that information, along with other data gathered from the flowing fluid, and calculates the amount of fluid that passes through the system.

The first chamber, or Body (4), properly positions the orifice plate in the flow stream. The second chamber, or Top (14), is a temporary holding place for the orifice plate during removing or installing operations (Refer to Orifice plate installation and removal instructions).

Important
The unit components have part numbers assigned on appropriate drawings and tables. Refer to Figure 1-2 and Table 1-4 for part numbers. Example: Body (4).

Figure 1-1: Daniel Senior Orifice Fitting - Flangnek option



Therefore, using a Senior may eliminate the need for bypass piping, valves, and other fittings necessary with conventional orifice fitting installations. Maintenance technicians can replace and repair all parts of the Senior, including the slide valve assembly, without removing the Body (4) from the line (refer to Maintain).

Daniel designs and manufactures all Senior units to applicable API-14.3 recommendations and in accordance with selected ANSI, ASME and ASTM specifications. As an option, Daniel also designs and manufactures fittings in compliance with ISO 5167.

Products bearing the "CE" mark are designed and manufactured in compliance with the European Union Pressure Equipment Directive (PED) 2014/68/EU (available on the internet).

Refer to the "Daniel Orifice Fittings Installation and Operating Instructions specific to the Pressure Equipment Directive", Part Number 3-9008-002 (available on the Daniel website).

White papers (available on the Daniel website):

- Upp, E.L. "Application of the Orifice Meter for Accurate Gas Flow Measurement": Daniel Measurement and Control Inc., Houston, Texas USA (1995)
- Upp, E.L. "Development of Orifice Meter Standards": Daniel Measurement and Control Inc., Houston, Texas USA (1995)
- Daniel Measurement and Control Inc. "Fundamentals of Orifice Meter Measurement": Daniel Measurement and Control Inc., Houston, Texas USA (1997)

- Kendrick, Ray. Effects of the Latest Revision of ANSI/API 2530/AGA 3 On Orifice Meter Primary Elements" Daniel Measurement and Control Inc., Houston, Texas USA (1997)
- Daniel Measurement and Control Inc. "Getting the Best Value From Daniel Senior Orifice Fittings": Daniel Measurement and Control Inc., Houston, Texas USA (1997)
- Cotton, Galen M. "Pulsation Effects on Gas Measurement": Daniel Measurement and Control Inc., Houston, Texas USA (1980)
- Husain, Zaki D. "Theoretical Uncertainty of Orifice Flow Measurement": Daniel Measurement and Control Inc., Houston, Texas USA (1990)
- Daniel Measurement and Control Inc. "Senior Orifice Fitting Technical Guide: DAN-DIF-TG11-1003 "Daniel Measurement and Control Inc., Houston, Texas USA (2014).

1.4 Conditions and specifications

NOTICE
Follow all the safety and equipment limits recommended in Conditions and specifications of this manual.

It is the owner's and/or purchaser's responsibility to comply with these parameters.

WARNING
PERSONAL PROTECTION HAZARD
Follow all parameters for the Senior Orifice indicated below.

Failure to comply may result in death and serious injury or equipment damage.

Table 1-2: Conditions and specifications

Product parameters and limitations:	
Fluid static pressures	Refer to ASME/ANSI B16 standards, and your fitting's material of construction, to determine the maximum operating temperature and pressure of your Senior. Daniel provides both the fitting's materials of construction and ASME/ANSI ratings information on the product nameplate.
Fluid phases:	Gas, liquid, vapor
Fluids measured:	Most fluids
Fluid temperature parameters:	-20° / +160° F (-29° C / +71° C) is the fluid temperature range for this product based upon the materials of construction (Refer to ASME codes [1]). Consult factory before operating this product outside of the specified temperature range.
Temperature and operating pressure limitations of Orifice Plate Seal materials:	-20° / +160° F (-29° C / +71° C) is the fluid temperature range for this product based upon the materials of construction (Refer to ASME codes [1]) . The following list describes the most common Orifice Plate Seal material and their available forms offered for use in Daniel Senior fittings. Consult factory before operating this product outside of the specified temperature range.

Table 1-2: Conditions and specifications *(continued)*

	HNBR:	Loose or Bonded: Material available for "loose" seal rings (2"-10") or "bonded" seal to orifice plates (12" and larger). Operating pressure is limited to lesser of ANSI Class MAOP or 1500 psig. O-ring: Used with Snap Seal Ring assemblies (2" and larger). Operating pressure is limited to ANSI Class MAOP.
	NBR:	Loose or Bonded: Material available for "loose" seal rings (2"-10") or "bonded" seal to orifice plates (12" and larger). Operating pressure is limited to lesser of ANSI Class MAOP or 1500 psig.
	FKM:	Loose or Bonded: Material available for "loose" seal rings (2"-10") or "bonded" seal to orifice plates (12" and larger). Operating pressure is limited to lesser of ANSI Class MAOP or 1500 psig. "O" Ring: Used with Snap Seal Ring assemblies (2" and larger). Operating pressure is limited to ANSI Class MAOP.
	PTFE:	Loose: Material used for orifice plate seal rings (2" and above). Operating pressure is limited to ANSI Class MAOP.
	FFKM:	"O" Ring: Used with Snap Seal Ring assemblies (2" and larger). Operating pressure is limited to ANSI Class MAOP.
Differential pressure:	Refer to API -14.3 or ISO 5167, as appropriate to your system.	
General arrangement dimensions:		
See List item.		
Time parameters:		
See Orifice Plate changing instructions		
Components:		
Maintenance intervals:	The owners and users of these products should perform regular scheduled intervals of maintenance activities. The recommended intervals are every month or as directed by the owner's maintenance procedures. Examine components during each scheduled maintenance period, site visits and during each orifice plate change. Replace any component that shows signs of wear or when damaged with parts specified for Daniel products.	
Seal replacement:	Examine seals during each scheduled maintenance period, site visits and during each orifice plate change. Replace any worn or damaged or non-functioning seals with parts specified for Daniel product.	

Table 1-2: Conditions and specifications *(continued)*

Fastener torque verification:	Check all fasteners for tightness during each scheduled maintenance period, site visits and during each orifice plate change. Use information provided in Section 5.3 as a starting point in establishing the proper fastener torque values for your particular service environment.
Corrosion allowance:	Daniel machines the meter bore of each fitting to close tolerances. This is to conform to industry measurement standards. The fitting's meter bore dimensions DO NOT include an allowance for corrosion. It is the end user's responsibility to specify a fitting's material of construction based upon their knowledge of the process fluid and environmental conditions of an intended service. Therefore, it is important that the end user to monitor any change in the gas or liquid composition during monthly exercises, site visits and plate changes that may create a corrosion concern (Reference: U.S. DOT, CFR Title 49: Part 192.477).
Environmental parameters:	
Application:	Surface and offshore (not for use in subsea applications)
Confined/open:	Designed for outdoor use. May be used in well ventilated spaces (buildings/ enclosed meter houses). Installation at product owner's discretion.
Site temperature:	Recommended atmospheric temperature ranges Maximum: +120 °F (+49 °C), Minimum: -20 °F (-29 °C).
Site humidity:	No limit
Site elevation:	No limit
Proximity to population:	Reference: Class 1 location: U.S. DOT, CFR Title 49: Part 192.5.
Proximity to traffic:	The owner must protect the fitting from accidental damage by vehicular traffic or other causes, by either placing the unit at a safe distance from the traffic, or installing barricades around the unit.
Proximity to equipment:	Install the Senior in a well ventilated place, not less than 3 feet (914 millimeters) from any source of ignition or any source of heat which might damage the unit.
Interface parameters:	
Replacement parts:	Use only replacement parts specified for Daniel products. Unauthorized parts and procedures can affect this product's performance and place the safe operation of your process at risk.
Aftermarket attachments:	Use of pressure sensing equipment, drain valves, and other accessories (e.g., needle valves, multi-port valves, transmitters, 3-pin recorders... etc.) are permissible. The use of aftermarket equipment must be installed and operated as directed by the after-market equipment manufacturer, and their warranties and replacements are not contained within the scope of this document.

Table 1-2: Conditions and specifications *(continued)*

Pipe supports:	The owner must employ sound engineering principles to design the support systems for the flow measurement system (or meter tube). It is important that the design engineer develop a method to support the entire weight (equipment, piping and fluid) of the system. The method developed must prevent bending to reduce the potential of creating unwanted stress at welded joints and flanges. Unwanted stresses may lead to leaks and may ultimately lead to failure or rupture of the flow measurement system.
Vandalism/ Tampering:	It is the responsibility of each product owner to protect the Senior from vandalism, tampering or other unauthorized activity.

(1) It is ultimately the responsibility of the Owner or End User to determine suitable materials of construction suitable for a service conditions.

1.5 Parts and materials lists

1.5.1 Trim options

Table 1-3: Senior Fitting Trim options(1)

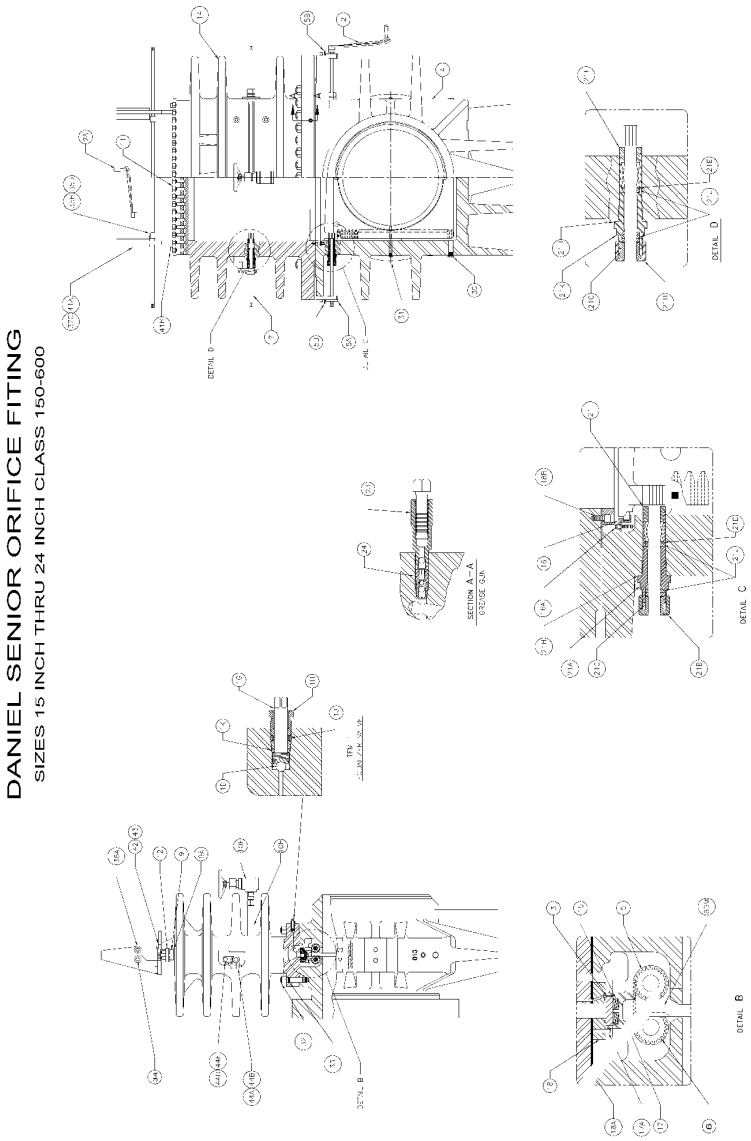
"A"	Materials offered for liquid or dry gaseous, non-corrosive ("sweet") fluids
"NACE"	Materials offered for dry, non-corrosive ("sour") H_2S-containing gases
AASG	Materials offered for liquid or wet gaseous, mildly corrosive ("sour") H_2S-containing fluids
316SS PIC	Materials offered for liquid or wet gaseous, moderately corrosive ("sour") H_2S-containing fluids
22CR duplex	Materials offered for liquid or wet gaseous, severely corrosive ("sour") H_2S-containing fluids
Mildly corrosive	≦3.0 mpy
Moderately corrosive	> 3.0 - 8.0 mpy
Severely corrosive	>8.0 mpy
mpy = mils (0.001") penetration per year of corrosion based on carbon steel	

NOTICE
It is the ultimate responsibility of the owner and/or purchaser to specify a fitting's material of construction, including trim option, based upon their knowledge of the process fluid and environmental conditions of an intended service.

(1) Unless otherwise noted, materials as listed in the Parts Lists indicate standard "A" Trim product. For applications outside all parameters listed, please consult the factory.

1.5.2 Daniel Senior Orifice Fitting sizes 18"-24" 150-600

Figure 1-2: Daniel Senior Orifice Fitting sizes 18”-24” 150-600



All Parts on Daniel Senior Orifice Fittings may be replaced or repaired without removing the Daniel Senior Orifice Fitting body from the line.

Table 1-4: Daniel Senior Orifice Fitting sizes 18”-24” 600

Item no.	Description	Material	Quantity required		
			Size		
			18"	20"	24"
1D	Equalizer Valve (Complete):	SS	1	1	1
1G	Stem	316 SS	1	1	1
1H	Packing Nut	CS (ZP)	1	1	1
1J	1/4” Long Packing	PTFE	1	1	1
1J	3/8” Long Packing	PTFE	1	1	1
1K	Packing Washer	17-4 PH SS	1	1	1
2	Operating Wrench	Ductile Iron	2	2	2
3	Slide Valve Strip	316 Nitride	1	1	1
4	Body	Cast CS	1	1	1
(part of 4)	Plate Carrier Guide Pins		-	-	-
5	Slide Valve Shaft	CS (ZP)	1	1	1
5A-LH	Indicator Plate- Left Side	Cast Aluminum	1	1	1
5A-RH	Indicator Plate - Right Side	Cast Aluminum	1	1	1
5B	Indicator Pointer	SS	2	2	2
6	Lower Plate Carrier Shaft	CS (ZP)	1	1	1
7	Upper Plate Carrier Shaft	CS (ZP)	1	1	1
8DM	Plate Carrier - A/Nace	CS (ZP)	1	1	1
9	Sealing Bar	CS (ZP)	1	1	1

Table 1-4: Daniel Senior Orifice Fitting sizes 18"-24" 600 *(continued)*

Item no.	Description	Material		Quantity required		
				Size		
				18"	20"	24"
9A	Sealing Bar Gasket	Composite		1	1	1
10F	Bleeder Valve (Assembly):	CS w/13Cr Stainless Trim		1	1	1
(used w/ 10F)	Threaded Both Ends CS Nipple	CS		1	1	1
11	Clamping Bar Screw	Alloy Steel (ZP)	150-600	14	15	18
(used w/11)	Operating Wrench - Small	DI (ZP)		1	1	1
12	Clamping Bar	CS (ZP)		1	1	1
14	Top Chamber	Cast CS		1	1	1
(part of 14)	Plate Carrier Guide Rail			-	-	-
(part of 14)	Plate Carrier Guide Pins			-	-	-
15	Slide Valve Springs	316 SS		12	19	18
16	Slide Valve Carrier Guide	316 SS		2	2	2
16A	Ferry Head Cap Screw	Alloy Steel		4	4	4
17	Slide Valve Carrier	Cast CS		1	1	1
17A	Tapered Dowel Pin	CS		2	2	2
18	Slide Valve Seat			1	1	1
18A	Valve Seat / Body Top Gasket			1	1	1

Table 1-4: Daniel Senior Orifice Fitting sizes 18”-24” 600 *(continued)*

Item no.	Description	Material		Quantity required		
				Size		
				18"	20"	24"
18B	Valve Seat Screws Ferry Head Cap Screw	8640 HT37-43 RC Non-NACE		30	34	38
21 (top)	Stuffing Box			2	2	2
21(body)	Stuffing Box	CS (ZP)		4	4	4
22A	Bearing Plug and Stuffing Box Gasket	SS		6	6	6
23	Grease Gun (Complete)	CS (ZP) w/316 SS Stem		2	2	2
24	Grease Seal Double Ball Check Valve	316 SS with Balls		2	2	2
25	Packing Nut	CS (ZP)		6	6	6
25A	5/8 ID X 7/8 OD X 1/4 Packing Rings	PTFE		7	7	49
25A	5/8 ID X 7/8 OD X 3/8 Long Packing	PTFE		7	7	25
25A	5/8 ID X 7/8 OD X 1/2 Long Packing	PTFE		30	18	12
25B	Centering Ring	PTFE		12	6	12
26	Stuffing Box Gland	316 SS		6	6	6
28A	Packing Bushing and Retainer	316 SS		6	6	6
30	1 Hex Head Pipe Plug	CS (Chemically Treated)		1	1	1
31	1/2 Hex Head Pipe Plug	CS		2	2	2
32	Hex Nut	CS	150	34	36	34

Table 1-4: Daniel Senior Orifice Fitting sizes 18"-24" 600 *(continued)*

Item no.	Description	Material		Quantity required		
				Size		
				18"	20"	24"
			300	34	36	36
			600	34	40	36
			900	30	40	36
			1500	30	34	-
33	Double Ended Stud	Alloy Steel	150	34	36	34
			300	34	36	36
			600	34	40	36
			900	30	40	36
			1500	30	34	-
34	External Operating Shaft			1	1	1
35B	External Roller	Brass		2	2	2
35D	Roller Retainer Ring			2	2	2
36A	External Roller Shaft			1	1	1
*37C	Bushing	Bronze		4	4	4
41A (RH)	Plate Carrier Guide Bkt	Cast CS		1	1	1
41A (LH)	Plate Carrier Guide Bkt	Cast CS		1	1	1
41B	Hex HD Machine Screw	Low CS (ZP)		4	4	4
42	Plate Carrier Stop	CS (ZP)		1	1	1
43	Socket HD Shoulder Screw	Alloy Steel (ZP)		1	1	1
44A	Plate Carrier Brake Body	CS (Invest Cast)		1	1	1
44B	Plate Carrier Brake Band	Bronze		1	1	1

Table 1-4: Daniel Senior Orifice Fitting sizes 18”-24” 600 *(continued)*

Item no.	Description	Material	Quantity required		
			Size		
			18"	20"	24"
44C	Hex HD Low Bright Cap Screw	CS (ZP)	1	1	1
(used w/ 44C)	Hex Nut	CS (ZP)	1	1	1
44D	Plate-Carrier Brake Sleeve	CS (ZP)	1	1	1
44E	Plate Carrier Brake Sleeve Screw	CS (ZP)	1	1	1
(not listed)	ID Plate	304 SS	1	1	1
(not listed)	Warning Plate	316 SS	1	1	1
(not listed)	Instruction Plate	304 SS	1	1	1
(not listed)	Drive Screw PK type	18-8 SS	12	12	12
	Slide Valve Lubricant (3)	0.38 in. (9.5mm) diameter by 1.5in (38.1 mm) long			

Notes for Table 1-4:

(1) All Daniel Senior Orifice Fittings are supplied with pipe plugs on one side only. If additional quantities are required, please contact the factory directly.

- Locations of Equalizer Valve (1), Bleeder Valve (10F), and Grease Gun (23) may differ from diagrams shown in this manual.
- Slide Valve Lubricant: 0.38in (9.53mm) diameter by 1.5in (38.1mm) long is equivalent to some lubricant manufacturers’ “B” size stick. The quantity of lubricant a fitting described in this manual will require is dependent upon the state and condition of the fitting. Daniel recommends having one box of lubricant sticks (24 sticks per box) onhand when performing maintenance and plate inspection/change procedures.

(*) Indicates interchangeable parts for all line sizes of specified pressure rating(s).

General notes for Table 1-4:

- Most parts available in other materials upon customer request.
- CS (Carbon Steel), CRS (Cold Rolled Steel), NPT (National Pipe Thread) ZP (Zinc Plated), SS (Stainless Steel).
- The materials listed above indicate standard “A” trim. Various part materials are changed for “NACE” & “AASG” trim fittings.

- NACE MR0175 trims are available upon customer request.
- Other trim options available upon request. Consult factory.
- Shaded part numbers are for items which are fluid media PIC (parts in contact).

When ordering parts, please specify (1) :

- Catalog number
- Size
- Serial number and date of the original purchase
- Part number
- Material
- Quantity of parts required

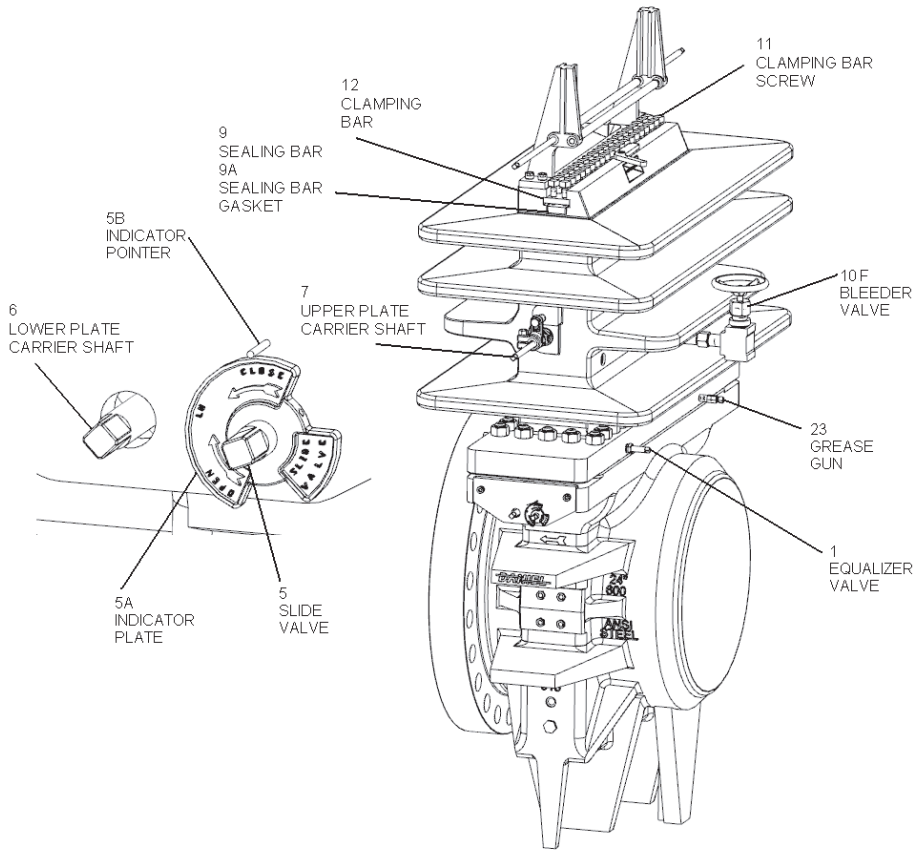
(1) Catalog number, size and serial number can be found on the fitting nameplate. Part item numbers and part materials for "NACE" trim only are found in Table 1-4

Part II
Install

2 General Information

2.1 Installation

Figure 2-1: Daniel Senior Orifice Fitting component identification



2.1.1 Information prior to installation

WARNING

HIGH PRESSURE HAZARD

Follow all instructions provided in this section when installing the Sealing Bar Gasket (9A), Sealing Bar (9), and Clamping Bar (12).

Failure to comply may cause pressurized fluids to escape, resulting in death or serious injury.

The Daniel Senior Fitting is an essential element in any orifice measurement system. Other elements in an orifice measurement system may include a meter tube, a flow conditioner, and various data recording devices.

Purchasers have the option of acquiring only a Daniel Senior fitting unit for later installation in a flow measurement system, purchasing a Senior Orifice fitting with a meter tube, or purchasing a complete flow measurement system containing a Senior Orifice fitting.

At our factories, Daniel personnel perform two unique tests on each Senior fitting for fluid retention. The first test is an internal hydrostatic SHELL test on a full assembled TOP (14) and BODY (4) with the slide valve seat (18) open, to a minimum pressure of 1.5 times its rated maximum allowable operating pressure. The second test is an internal hydrostatic SEAT test. With the slide valve seat (18) closed, Daniel personnel apply a minimum pressure of 1.1 times the rated maximum allowable operating pressure to the BODY (4) only.

Important
When purchasing only a Daniel Senior fitting, it is the responsibility of the both the product owners and product operating personnel to perform an internal hydrostatic shell test of the final meter tube assembly prior to service.

Product owners and product operating personnel performing an internal hydrostatic SEAT test of the Daniel Senior fitting prior to service should not exceed 1.1 times its rated maximum allowable operating pressure within the BODY (4) and with the slide valve seat (18) closed.

WARNING
FLUID EXPLOSION HAZARD
Never pressurize a unit above the limits recommended in this manual. Before pressurizing the Daniel Senior Fitting, confirm the maximum allowable operating pressure (MAOP) of each item in the system.

Over-pressurizing the Daniel Senior fitting could lead to an explosive release of fluid resulting in death, serious injury or damage to the Senior.

When assembling a flow measurement system that will contain a Daniel Senior Orifice Fitting, particular attention should be paid to the requirements for permanent joining of components. This will be to ensure optimal measurement performance and successful pressure test results. Referencing an appropriate measurement code (API-14.3, ISO 5167, etc.) will aid in this assembly.

NOTICE
Follow all the safety and equipment limits recommended in Conditions and specifications of this manual.

It is the owner's and/or purchaser's responsibility to comply with these parameters.

NOTICE
On installations built to comply with the European Union Pressure Equipment Directive (PED) 2014/68/EU, it is the responsibility of the end user to meet all essential safety requirements of the directive (available on the internet).
End users must pay particular attention to the requirements for permanent joining and non- destructive testing. Refer to the "Daniel Orifice Fittings - Installation and Operating

Instructions specific to the Pressure Equipment Directive", Part Number 3-9008-002 (available on the Daniel Flow website).

2.1.2 Storage

Follow your company's storage procedures when placing any measurement equipment into inventory. Spraying a light coat of rust inhibitor onto the inside bore of a Daniel Senior, and to the bore of the meter tube, may protect its surface finish during storage.

2.1.3 Preliminary Steps

NOTICE
Follow all the safety and equipment limits recommended in Conditions and specifications of this manual. It is the owner's and/or purchaser's responsibility to comply with these parameters.

The Senior may arrive at your site in any number of ways, usually as a component in a meter tube/measurement system, or as a loose fitting. If received as a loose fitting, then see the appropriate code (API-14.3, etc.) for assembly requirements.

It is the responsibility of the product operators to clean the Senior and all piping components of foreign matter such as welding debris, scale, oil, grease, and dirt before commissioning.

Record the serial plate data on the Senior's nameplate for future reference. Always provide the serial number and model number when ordering spare parts.

The factory places the plate carriers (8DM) inside the fitting for shipment.

The factory packages the Orifice Plates (13) and Seal Ring units separately from the fitting.

2.1.4 Severe service conditions

If product owner expects to encounter gas or liquid composition where there is a likelihood of sediment accumulation within the fitting, then Daniel recommends that the owner instruct their operators to remove Drain Valve Plug (30) and install a blow-down valve in its place.

2.1.5 Corrosive service

Corrosive environments may affect both the external and internal surfaces of the Senior. External corrosive environments are defined as those conditions that affect the outer surfaces of the Senior, while an internal corrosive environment is a condition that affects the surface inside the Senior. Read, understand, and follow instructions in the sections below if an internal or external corrosive environment exists.

External corrosive environments

For Seniors located in external corrosive environments (offshore platforms, marine terminals, etc), Daniel recommends replacing the standard carbon steel Equalizer Valve (Complete) (1), Bleeder Valve (Complete) (10F), Grease Gun (Complete) (23) and Drain

Valve Plug (30) with the stainless steel versions listed in the "Corrosive Service" column (refer to Low temperature service).

Internal corrosive environments

It is the end user's responsibility to specify a fitting's material of construction based upon their knowledge of the process fluid and environmental conditions of an intended application. A number of trim packages are available for severe service to improve durability of the Senior fitting (Refer to Table 1-3).

The inside diameter specifications of a Senior fitting are exact. No allowance is provided for corrosion of the inside diameter.

2.1.6 Low temperature service

The fitting's material of construction is just one factor to consider when placing an orifice fitting into a low temperature service. Other factors to consider are the temperature characteristics of the slide valve lubricant, and the temperature limitations of the orifice plate seal material.

Operating temperatures have an effect on all valve lubricant Daniel offers. Lower temperatures increase a valve lubricant's viscosity. Higher viscosity lubricant is more difficult to transfer from the grease gun, through the grease channels and to the slide valve. Additionally the application of a high viscosity lubricant into a Daniel fitting may result in an uneven the distribution of lubricant around the Slide Valve Seat (18). An uneven distribution of lubricant may allow leakage to occur between the Slide Valve Seat (18) and the Slide Valve Strip (3) during a plate change operation. Refer to Lubricant information to help you to select a lubricant for your application.

Orifice plate seal material is another factor to consider when selecting components for low temperature services. Refer to Conditions and specifications "Orifice plate seal material temperature limitations" to help you to select an orifice plate seal for your application.

For Seniors located in low temperature environments (atmospheric temperature ranges of +32° F [0° C] to -20° F [-29° C]), Daniel recommends replacing the standard carbon steel Equalizer Valve (Complete) (1), Bleeder Valve (Complete) (10F), Grease Gun (Complete) (23) and Drain Valve Plug (30) with the low temperature versions listed in the "Low Temp Service" column (refer to Low temperature service).

Table 2-1: Alternate components

Part number	Description	Plug size	Standard service	Stainless steel corrosive service	Low temperature service
1	Equalizer Valve	complete	1-504-01-011	1-504-01-004	1-504-01-016
10B	Bleeder Valve	2"/14" (complete)	1-504-01-026	1-504-01-040	1-504-01-040
10F	Bleeder Valve	16" only (complete)	1-504-01-028	1-504-01-041	1-504-01-041
23	Grease Gun	Complete	1-504-01-051	1-504-01-050	1-504-01-071
30	Drain Plug	1/2" - 14 NPT	1-507-01-103	1-507-01-143	1-507-01-170

Table 2-1: Alternate components *(continued)*

Part number	Description	Plug size	Standard service	Stainless steel corrosive service	Low temperature service
30	Drain Plug	3/4" - 14 NPT	1-507-01-104	1-507-01-144	1-507-01-171
30	Drain Plug	1" - 11.5 NPT	1-507-01-105	1-507-01-145	1-507-01-172

2.1.7 Design considerations

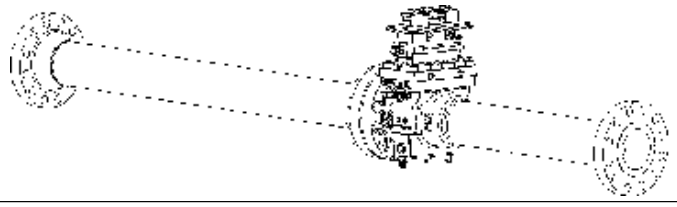
Owners and operators select and place Daniel fittings in a variety of flow measurement services around the world with successful results. Daniel personnel understand that each flow measurement service has its own set of unique process and environmental conditions. Although Daniel designs, builds and offers a product line that may be applicable to most flow measurement services, it is the end user's responsibility to match the fitting to the service to achieve successful results.

Important
Product owners and operating personnel must evaluate both process fluid and environmental conditions of an intended service and select the appropriate fitting to match those service requirements. Once selected, the product owners and operating personnel must place the Daniel fitting in a well-designed piping system.

Below is a list of some, but not all, pipe design conditions to consider:

- Service operating pressure
- Service testing pressures
- Service process temperature and ambient site temperatures
- Mass of fluid in process and test conditions
- Chemical composition and toxicity of fluid in operating conditions
- Traffic, wind and earthquake at loading site
- Reaction forces and moments (meter position, supports, attachments, piping, etc.)
- Corrosion, erosion, fatigue, etc.
- Decomposition of unstable fluids in operating and test conditions
- Possible damage from external fire

Figure 2-2: Daniel Senior Flangnek™ Fitting with meter tube

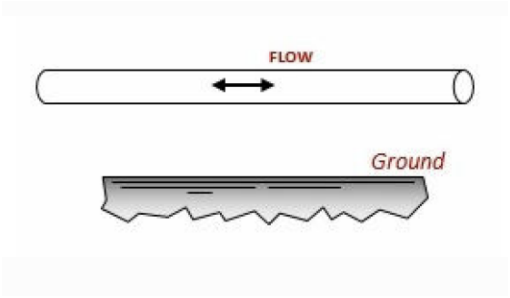


2.1.8 Installation configurations

Up to 12" nominal size (all ANSI Classes)

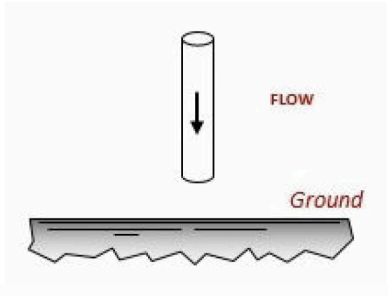
Product owners and operating personnel may install any Daniel Senior fitting, up to 12-inch line size, in one of two configurations. One configuration is to install the fitting in piping system with product flowing in a horizontal direction (Figure 2-3). The other is to install the fitting in piping system with product flowing in a vertical direction (Figure 2-4).

Figure 2-3: Horizontal Flow



Installing the fitting in a vertical flow direction (see Figure 2-4) gives a product owner and operating personnel the option to fix the fitting in any position parallel to the ground. Although the insertion of the fitting in the vertical flow direction can be vertical UP or vertical DOWN, it is recommended the fitting be in the vertical down flow direction to reduce the potential of debris collecting on the orifice plate.

Figure 2-4: Vertical flow



Installing the fitting in a horizontal flow direction gives a product owner and operating personnel the option to fix the final position of the fitting parallel (Figure 2-5 or Figure 2-7), or perpendicular (Figure 2-6) to the ground as shown.

Figure 2-5: Parallel to the ground "Right side" position

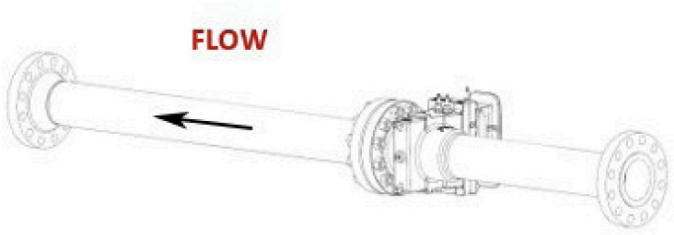


Figure 2-6: Perpendicular to the ground "Normal" position

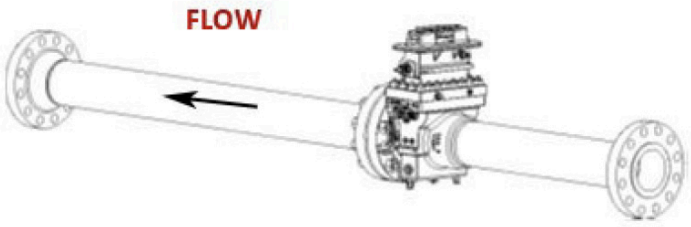
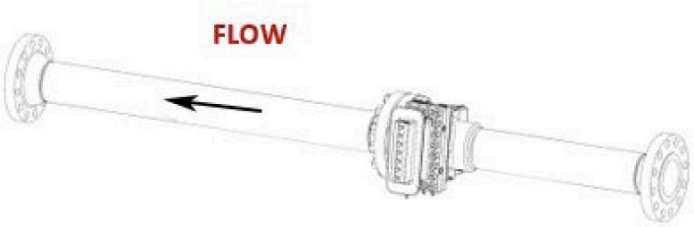


Figure 2-7: Parallel to the ground "Left side" position



14" and larger nominal size (all ANSI Classes)

14" and larger Senior fittings are recommended to be installed only in Horizontal Flow - "Normal Position" direction per Figure 2-6.

2.1.9 Installation of Senior Orifice Fitting 18"-24"

Installation personnel must confirm that the line flow direction corresponds to the flow arrow cast on the Senior body. The 18”-24” Senior should be installed in any horizontal line with the plate access opening in a vertical (upward) position.

Procedure

1. Confirm the minimum operating clearance around the Senior for the following:
   - Operating clearance for Clamping Bar removal (both directions preferred)
   - Operating clearance for Plate Carrier Assembly removal
   - Operating clearance for Wrench removal
   - Operating clearance for Meter Tap removal

   Important
   Refer to Daniel Measurement and Control Inc.“Senior Orifice Fitting Technical Guide: DAN-DIFTG11- 1003 “Daniel Measurement and Control Inc., Houston, Texas USA (2003) for clearances.

2. Check shipment to confirm that the shipping kit contains both operating wrenches. The Operating Wrench - Gear Shaft (2) and Operating Wrench - Clamping Bar (2A). Also two Grease Guns (23), two Slide Valve Indicator Plates (5A), two Slide valve Indicator Pointers (5B), Bleeder Valve Assembly (10F), and Bleeder Valve Nipple (10H).
   a) Install the Grease Gun(s) (23) into holes in the base of the Top (14) as stated below:
      - Remove the plastic shipping plugs.
      - Put thread sealer on the end threads of the Grease Gun Body (23) and tighten securely.
      - Check the accessibility to the Grease Gun(s) (23) after installation.
      - Adjust the Senior’s position if required.

3. Install Bleeder Valve (10F) and Bleeder Valve Nipple (10H) by first removing plastic or shipping plug from the hole on the downstream of the Top - Lower Section (14L), putting thread sealer on both end threads of Bleeder Valve Nipple (10H), inserting Bleeder Valve Nipple (10H) into hole on Top - Lower Section (14L), then inserting Bleeder Valve Nipple (10H) into Bleed Valve Assembly (10F), and securely tighten complete assembly.
4. Install the Slide Valve Indicator Pointers (5B) on the Body (4) flange. Do this by tapping the two drive screws into the holes located above the Slide Valve Gear Shaft (5) on each side of the Senior.
5. Install both Slide Valve Indicator Plates (5A-LH/5A-RH) on the Slide Valve Gear Shaft (5), directly below each Slide Valve Indicator Pointer (5B). Orient each Slide Valve Indicator Plate (5A-LH/5A-RH) as stated below:
   a) The left hand side, Slide Valve Gear Shaft (5) facing with the flow: when the Slide Valve Gear Shaft (5) is rotated clockwise until it stops, the left hand

Slide Valve Indicator Plate (5A-LH) word OPEN should appear below the Slide Valve Indicator Pointer (5B).

b) Install the Left Slide Valve Indicator Plate (5A-LH) on the Slide Valve Gear Shaft (5) in this position and tighten set screw securely.

c) The right hand side, Slide Valve Gear Shaft (5) facing with the flow: when the Slide Valve Gear Shaft (5) is rotated counterclockwise until it stops, the right hand Slide Valve Indicator Plate (5A-RH) word OPEN should appear below the Slide Valve Indicator Pointer (5B).

d) Install the Right-Hand Slide Valve Indicator Plate (5ARH) on the Slide Valve Gear Shaft (5) in this position and tighten the set screw securely.

e) Note that right hand and left hand Slide Valve Indicator Plates (5A-RH/5A-LH) are different and not interchangeable.

f) After installation, rotate the slide valve Slide Valve Gear Shaft (5) until it stops. The word CLOSED should appear below the Slide Valve Indicator Pointer (5B).

The Seniors leave the factory with the Plate Carrier (8DM) in the bottom of the Body (4). Daniel ships the Senior in this manner to prevent damage to the Plate Carrier (8DM) or fitting internals during transit.

6. Whether or not the Senior arrives directly from the factory, installation personnel must open the Top by removing the Clamping Bar (11) and Sealing Bar (9) in addition to turning the Slide Valve Gear Shaft (5) to the “OPEN” position to visually confirm that the Plate Carrier (8DM) is inside the unit prior to placing it in service.
7. The installation technicians must remove the Plate Carrier (8DM) before performing any installation tests.
8. To remove the Plate Carrier (8DM) for installation testing, fully open the Slide Valve Gear Shaft (5).

CAUTION

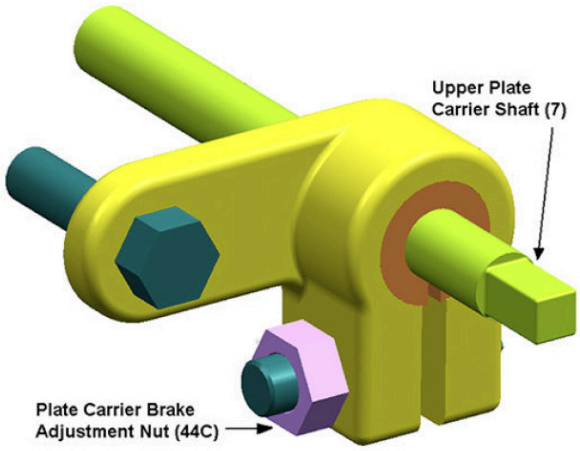
TIGHTENING HAZARD

The Plate Carrier Brake Adjustment Nut (44C) must be tightened to provide additional squeeze to the Upper Plate Carrier Gear Shaft (7).

Failure to comply may cause the Plate Carrier (8DM) to fall into the body during installation testing, resulting in injury and damage to the Senior.

9. Tighten the Plate Carrier Brake Adjustment Nut (44C) mounted on the Top. Doing so will provide additional squeeze to the Upper Plate Carrier Gear Shaft (7) that will prevent the Plate Carrier (8DM) from falling into the Body (4) during this operation.

   The amount of torque applied to the Plate Carrier Brake Adjustment Nut (44C) is unique to each Senior. Therefore, it may take several tries to achieve the proper torque. Daniel recommends that the installation technician first apply a torque to the Plate Carrier Brake Adjustment Nut (44C), then turn the Upper Plate Carrier Gear Shaft (7) with the Operating Wrench - Gear Shaft (2), until the torque required to turn the Upper Plate Carrier Gear Shaft (7) is slightly less than the amount required to lock it in place (cannot be rotated by hand).



10. Rotate the Lower Plate Carrier Shaft (6), lifting the Plate Carrier (8DM) out of the Body (4). Continue to rotate the Lower Plate Carrier Shaft (6) until you visually confirm that the Upper Plate Carrier Gear Shaft (7) is rotating. Once you have visual confirmation that it is rotating, stop rotating the Lower Plate Carrier Shaft (6) and slowly reduce the amount of force applied to the Operating Wrench - Gear Shaft (2).
11. If the plate remains in place, the proper amount of torque has been applied to the Plate Carrier Brake Adjustment Nut (44C) and you can continue with the next step. If the plate begins to drop, slowly lower it back down into the Body (4) using the Operating Wrench - Gear Shaft (2) until it comes to rest. Repeat Step 8.
12. With the Plate Carrier (8DM) held in place by the Upper Plate Carrier Gear Shaft (7), remove the Operating Wrench - Gear Shaft (2) from the Lower Plate Carrier Shaft (6) and place it on the Upper Plate Carrier Gear Shaft (7).
13. Continue to rotate the Upper Plate Carrier Gear Shaft (7) until the Plate Carrier (8DM) engages the External Plate Carrier Gear Shaft (34) and will no longer raise.
14. The Plate Carrier (8DM) should remain in this position as the force applied to the Operating Wrench - Gear Shaft (2) is slowly relieved. If it does not, lower the Plate Carrier (8DM) completely back into the Body (4) and repeat Step 8.
15. With the Plate Carrier (8DM) held in place by the Upper Plate Carrier Gear Shaft (7), remove the Operating Wrench - Gear Shaft (2) from the Upper Plate Carrier Shaft (7) and place it on the External Plate Carrier Gear Shaft (34).
16. Rotate the External Plate Carrier Gear Shaft (34) until the Plate Carrier clears the Top and is positioned in the Plate Carrier Guide Brackets (41A).
17. Continue to apply the necessary force to hold the Plate Carrier (8DM) suspended above the Top and position the Plate Carrier Stop (42) across the slot located on the top of the Top. The Plate Carrier Stop will prevent the Plate Carrier (8DM) from returning back into the Top. Slowly turn the Operating Wrench - Gear Shaft to lower the Plate Carrier (8DM) until it rests on the Plate Carrier Stop (42).
18. Attach rigging to the Plate Carrier (8DM) in order to remove it from the Senior. Insure that all rigging used in removing the Plate Carrier (8DM) from the Senior is of a sufficient capacity rating and allows the technician to control the Plate Carrier (8DM). Once removed, place the Plate Carrier (8DM) in a safe, protected area for use later in the installation process.

WARNING

CRUSHING HAZARD

During plate carrier installation or removal, properly support the unit so that it can be easily controlled by the user.

Failure to comply could allow the plate carrier to fall from the rigging, resulting in serious injury or death.

19. Replace the Sealing Bar Gasket (9A), Sealing Bar (9) and Clamping Bar (12) and tighten the Clamping Bar Screws (11) to the required torque.
20. Install gaskets on any line flanges and/or weld the meter tube in the line. If your Senior is a flanged model, installation personnel must tighten the flange bolts to the appropriate torque values for the flange rating.

Part III
Operate

3 Commissioning

3.1 Commission the Daniel Senior Orifice Fitting

DANGER

FLUID EXPLOSION HAZARD

The Senior is a device that contains fluid at elevated pressure.

Failure to follow the instructions in this manual will result in death or serious injury.

Commissioning is the process of verifying that a system performs in accordance with the user's intended operational, maintenance, and measurement requirements. Daniel provides the following procedures to guide personnel in verifying that the Senior performs in accordance with the user's intended requirements.

Pre-Commissioning

Ensure that the following checklist is met prior to commissioning the Senior:

- The internal pressure throughout the Senior is equal to atmospheric pressure (0 psig / 0 barg).
- Confirm that the flow directional indicator (arrow or "INLET"/"OUTLET" tags) positioned on the Senior Body (4) corresponds with the intended fluid flow direction of the measurement system.
- Check shipment to verify that the shipping kit contains an Operating Wrench (2), Grease Gun (23), Indicator Plate (5A-LH marked "LH" for left-hand side operation and 5A-RH marked "RH" for right-hand side operation) and (2 EA) Indicator Pointer (5B).
- Confirm the proper operating clearance around the Senior per information contained in the Daniel technical guide "DAN-DIF-TG-11-1003".
- Check accessibility and Operating Wrench (2) clearance at the following Senior locations:
    1. Lower Plate Carrier Shaft (6)
    2. Upper Plate Carrier Shaft (7)
    3. Bleeder Valve (10B10F)
    4. Equalizer Valve (1)
    5. Slide Valve Shaft (5)
- Confirm the Operating Wrench (2) operational clearances for the Plate Carrier (8DM) extraction, and meter tap equipment draw clearance.
- Install the Grease Gun(s) (23) into holes in the base of the Top (14) as stated below:
    - Remove the plastic shipping plugs
    - Put thread sealer on the end threads of the Grease Gun Body (23) and tighten securely. Check the accessibility to the Grease Gun(s) (23) after installation.
    - Adjust the Senior's position if required.

- Install the Indicator Pointer (5B) on to the Body (4) by tapping the two drive screws into the holes located above the Slide Valve Shaft (5).
- Install the Indicator Plates (5A) on the Slide Valve Shaft (5), directly below the Indicator Pointer (5B).
- Orient the Indicator Plate (5A-LH and 5A-RH), as stated below, depending on the shaft's left or right side location (The right hand and left hand Indicator Plates (5A-LH and 5A-RH) are different and not interchangeable):
  - Shaft on the left hand side facing with the flow (standard LH position): when the shaft is rotated clockwise until it stops, the Indicator Plate (5A-LH) word OPEN should appear below the Indicator Pointer (5B). Install the Indicator Plate (5A-LH) on the shaft in this position and tighten the Set Screw (10G) securely.
  - Shaft on the right hand side facing with the flow (standard RH position): When the shaft is rotated counterclockwise until it stops, the Indicator Plate (5A-RH) word OPEN should appear below the Indicator Pointer (5B). Install the Indicator Plate (5A-RH) on the shaft in this position and tighten the Set Screw (10G) securely.
  - After installation, rotate the Slide Valve Shaft (5) until it stops. The word CLOSED on both Indicator Plates (5A-LH and 5A-RH) should appear below the Indicator Pointer (5B).
- Plate Carrier shipment verification
  The Seniors leave the factory with the Plate Carriers (8DM) in the Body (4) to prevent the damage of the Plate Carrier (8DM) or the slide valve assembly during transit. Whether or not the Senior arrives directly from the factory, installation personnel must remove the Clamping bar and open the Top (14) and the Slide Valve Shaft (5) to ensure that the Plate Carrier (8DM) is inside. The Plate Carrier (8DM) should be removed before performing any tests.
- Orifice plates and Seal Rings verification
  The factory packages the Orifice Plates (13) and Seal Rings units (8E-DSC or 8E-DS; 8TSC or 8TS; 8MSC or 8MS; 8SNC or 8SN) separate from the fitting.
- With the slide valve in the fully opened position, follow these instructions:
  - Rotate the Lower Plate Carrier Shaft (6) first.
  - Rotate the Upper Plate Carrier Shaft (7) to remove the Plate Carrier (8DM).
  - Put the Plate Carrier (8DM) in a safe, protected area for use later in the installation process.
  - Replace the Sealing Bar (9 or 9HP), the Sealing Bar Gasket (9A, 9AHP or 9CF) and the Clamping Bar (12)
  - Tighten and secure all Clamping Bar Screws (11) per the information and procedures contained in Torque information

CAUTION

LOOSE CLAMPING BAR SCREW HAZARD

The factory assembled and shipped this product with loose clamping bar screws. Tighten all Clamping Bar Screws(11) per the information and procedures contained in Torque information before applying pressure to this product.

Failure to comply may result in death, serious injury or equipment damage.

3.2 Commission the line pressure test

After installing the Daniel Senior Orifice Fitting, personnel must perform a pressure test for the service line that includes, but is not limited to, the meter tube and Senior.

Commissioning line pressure test start checklist:

- The internal pressure throughout the Senior is equivalent to atmospheric pressure (0 psig / 0 barg).
- The Slide Valve Shaft (5) must be in the "OPEN" position.
- The Equalizer Valve (1) must be in the "OPEN" position.
- The Bleeder Valve (10F) must be in the "CLOSED" position.
- Orifice Plate Carrier (8DM) is installed in the Senior Body (4).
- The Orifice Plate (13) and Orifice Plate Sealing Unit (8E-DS or 8TS or 8MS or 8SN) is not installed on the Orifice Plate Carrier (8DM).
- The Sealing Bar Gasket (9A) and Sealing Bar (9) are installed.
- The Clamping Bar (12) is installed.
- All Clamping Bar Screws (11) are tightened and secured per the information and procedures contained in Torque information

WARNING

FLUID EXPLOSION HAZARD

Never pressurize a unit above the limits recommended in this manual. Before pressurizing the Daniel Senior Fitting, confirm the maximum allowable operating pressure (MAOP) of each item in the system.

Over-pressurizing the Daniel Senior fitting could lead to an explosive release of fluid resulting in death, serious injury or damage to the Senior.

Procedure

1. Install a pressure gauge in a location on the Senior or the piping system that will indicate the pressure contained in the Fitting. The gauge should have a maximum pressure rating slightly above the maximum pressure to be applied during the test.

   Important
   Daniel hydrostatically tests every Senior unit for fluid retention, under factory controlled conditions , to a minimum pressure of 1.5 times its rated maximum allowable operating pressure. If purchased alone, without a meter tube, any hydrostatic testing of the meter tube assembly is the responsibility of the product owners or product operating personnel.

2. Slowly pressurize the system containing the Senior at a rate of 1 psig per second (0.07 bars per second) until the pressure inside the Senior reaches 20 psig (1.4 barg) then stop and hold pressure for five minutes.

Important
During the five-minute hold period, apply a leak detection solution to all joint and connector areas of the Senior and line connections. No leakage should be visibly detectable or audibly detectable during the hold period.

3. If a leak is detected, mark the leak area with a marker and reduce the pressure inside the Senior to 0 psig (0 barg). Tighten any fastener or connector adjacent to the leak area and repeat the leak test again.
4. If after several attempts to contain the leakage, the leakage persists, call Flow Lifecycle Services for Daniel products for assistance. Contact information is found in the back of this manual.
5. Once the 20 psig (1.4 barg) leak test is complete, and no leaks are detected, slowly raise the pressure inside the Senior at a rate of 10 psig per second (0.7 barg per second) to the maximum operating pressure of the lowest rated item in the system. However, it should not to exceed 1.5 times the noted rated working pressure of the Senior. Hold the maximum operating pressure on the system for a period of ten minutes.

Important
During the ten-minute hold period, apply a leak detection solution to all joint and connector areas of the Senior and line connections. No leakage should be visibly detectable or audibly detectable during the hold period.

6. If a leak is detected, mark the leak area with a marker and reduce the pressure inside the Senior to 0 psig (0 barg). Tighten any fastener or connector adjacent to the leak area and repeat the leak test again.
7. If after several attempts to contain the leakage, the leakage persists, call Flow Lifecycle Services for Daniel products for assistance.

WARNING
PRESSURIZED FLUID HAZARD
When opening the bleeder valve (10F) or venting the Top (14) through the bleeder valve (10F), direct the released pressurized fluid away from any individual in accordance with local environment regulations to a safe area.

The bleeder valve (10F) releases pressurized fluid that may cause contamination and/or accumulation of volatile gas mixtures. Failure to comply may cause death or serious injury.

8. Slowly release the pressure from the Senior until the pressure gauge reads zero (0) psig by venting the Top (14) through the bleeder valve (10F).
9. Close the slide valve by rotating the Slide Valve Shaft (5). Close the Equalizer Valve (1). Open the Bleeder Valve (10F).
Steps 10 and 11 are for the Seniors equipped with lubricated slide valves only. For Soft Seat equipped Seniors, skip these steps.
10. Once the valves are in position as described in Step 9, remove the stem from the Grease Gun (23) and insert a lubricant stick into the Grease Gun (23).

WARNING
PRESSURIZED FLUID HAZARD
Using the Grease Gun (23), inject grease into the slide valve seat channels at a rate of 4 to 6 turns per minute and only under the following conditions:

- Bleeder Valve is open.
- Sealing bar/Clamping bar is in place and tight.

Injection of the grease at a faster rate will lead to the separation of the valve strip from the valve seat, resulting in release of pressurized fluid which may cause death or serious injury.

11. Return the stem to the Grease Gun (23) and begin turning the stem by hand into the Grease Gun (23) until resistance is felt.

3.3 Orifice Plate Installation

After completion of the commissioning line pressure test in Commission the line pressure test, install and lower the Plate Carrier (8DM) and Orifice Plate Assembly (13) into the Body (4) to begin measurement operations.

WARNING
EXPLOSION HAZARD
Ensure that the Daniel Senior Orifice Fitting is at atmospheric pressure.

Performing the Orifice Plate (13) installation with the Senior above atmospheric pressure may lead to an explosive release resulting in death or serious injury.

Orifice Plate (13) installation start checklist:

- Senior is at atmospheric pressure .
- The Slide Valve Shaft (5) must be in the "OPEN" position
- The Equalizer Valve (1) must be in the "OPEN" position
- The Bleeder Valve (10F) must be in the "OPEN" position

Procedure

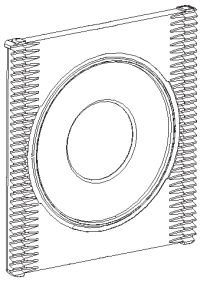
1. Remove the Clamping Bar (12) by loosening all the Clamping Bar Screws (11), two turns maximum, and by sliding the bar from the slot.
2. Remove the Sealing Bar (9) and the Sealing Bar Gasket (9A).
3. The three basic components of all Daniel Plate Carrier (8DM) assemblies are:
   - Plate Carrier (8DM)
   - Orifice Plate Seal Ring (8TS/8TSC, 8E-DVS)
   - Orifice Plate (13)
     a) Assemble the Orifice Plate (13), with the appropriate seal ring, into the Plate Carrier (8DM). If a seal is used, lubricate both seal faces with a safe-for-service light oil or grease. Refer to "Senior Orifice Fitting Technical Guide: DAN-DIF-TG-11-1003".

Important
Install the Plate Carrier (8DM) assembly into the Senior with the gear rack facing downstream (refer to (Figure 3-1) and (Figure 3-2)).

Failure to align and install Plate Carrier (8DM) assembly as instructed will cause erroneous measurement results.

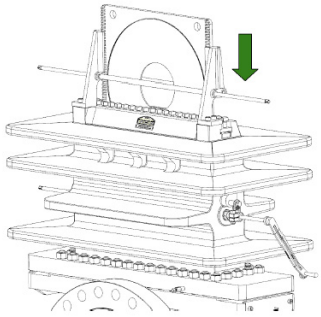
4. Align the plate carrier gear rack teeth to the Plate Carrier (8DM) shaft pinion on the Senior when installing the Plate Carrier (8DM) assembly.

Figure 3-1: Plate carrier (8DM) plunger



The diagram below depicts the proper orientation of the Plate Carrier (8DM) assembly prior to lowering it into the measurement position in the Senior.

Figure 3-2: Orientation of plate carrier (8DM) prior to installation



NOTES:

- The gear rack side of the Plate Carrier (8DM) assembly must face the downstream direction of flow.
- If the Orifice Plate (13) bore has a bevel, the bevel shall face the downstream direction of flow.

5. Rotate the Upper Plate Carrier Shaft (7) a minimum of 1/4 turns OPPOSITE of the direction used to lower the Plate Carrier (8DM) assembly. This will allow it to "align" itself with the Top (14) shaft gear teeth.
6. Once the Plate Carrier (8DM) assembly is aligned, rotate the Upper Plate Carrier Shaft (7) in the direction to lower it from the Top (14) to the Body (4).

7. Once the Plate Carrier (8DM) assembly is clear of the Upper Plate Carrier Shaft (7), rotate the Lower Plate Carrier Shaft (6) until the Plate Carrier (8DM) assembly is completely inserted into the Body (4).
8. Install the Sealing Bar (9 or 9HP), the Sealing Bar Gasket (9A), and the Clamping Bar (12) in position on the Top (14) and tighten the Clamping Bar Screws (11). Refer to Torque information for torque values.

   CAUTION
   LOOSE CLAMPING BAR SCREW HAZARD
   The factory assembled and shipped this product with loose clamping bar screws. Tighten all Clamping Bar Screws(11) per the information and procedures contained in Torque information before applying pressure to this product.

   Failure to comply may result in death, serious injury or equipment damage.

9. Rotate the Slide Valve Shaft (5) to the CLOSED position. This closes the slide valve, separating the Body (4) from the Top (14).

   Steps 11 and 12 are for Seniors equipped with lubricated slide valves only. For Soft Seat equipped Seniors, skip to step 13.

10. Once the Slide Valve Shaft (5) is in the CLOSED position, remove the stem from the Grease Gun (23) and insert a lubricant stick (Refer to Lubricant information) into the Grease Gun (23).

    WARNING
    PRESSURIZED FLUID HAZARD
    Using the Grease Gun (23), inject grease into the slide valve seat channels at a rate of 4 to 6 turns per minute and only under the following conditions:

    - Bleeder Valve is open.
    - Sealing bar/Clamping bar is in place and tight.

    Injection of the grease at a faster rate will lead to the separation of the valve strip from the valve seat, resulting in release of pressurized fluid which may cause death or serious injury.

11. Return the stem to the Grease Gun (23) and begin turning the stem by hand into the Grease Gun (23) until resistance is felt. Once resistance is felt, use the supplied Daniel Operating Wrench (2) to continue to turn the stem at a rate of 4 to 6 turns per minute.
12. Close both the Equalizer (1) and the Bleeder Valves (10F).
13. Remove any commissioning equipment (flanges, tubing, etc.) from the system.

    The Senior is now ready for final pressurization and operation.

Part IV
Maintain

4 Maintenance recommendations

4.1 Maintenance

4.1.1 Recommendations for lubrication

Under normal measurement conditions, Daniel recommends lubricating the slide valve and exercising several key components of the Daniel Senior Orifice Fitting every thirty days (Refer to Component exercise). If the plate changing operations are performed within this period, omit this operation.

4.1.2 Lubrication

Important
The information in this section, Lubrication, DOES NOT apply to Seniors equipped with Soft Seat slide valves.

In order to perform the maintenance operation described in this section, the following maintenance check list must be met first:

- The slide valve must be in the "CLOSED" position.

WARNING
PRESSURIZED FLUID HAZARD
When opening the bleeder valve (10F) or venting the Top (14) through the bleeder valve (10F), direct the released pressurized fluid away from any individual in accordance with local environment regulations to a safe area.

The bleeder valve (10F) releases pressurized fluid that may cause contamination and/or accumulation of volatile gas mixtures. Failure to comply may cause death or serious injury.

- The Bleeder Valve (10F) must be in the "OPEN" position.
- The Equalizer Valve (1) must be in the "CLOSED" position.
- The Senior must contain 100 psig minimum line pressure.

Procedure

1. Remove the stem from the Grease Gun (23) and insert a lubricant stick into the Grease Gun (23).

Figure 4-1: Step 1

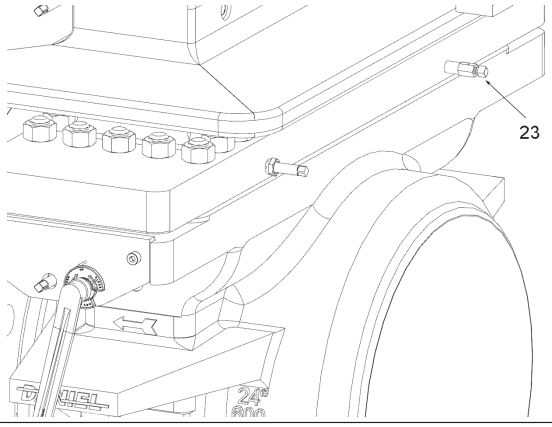
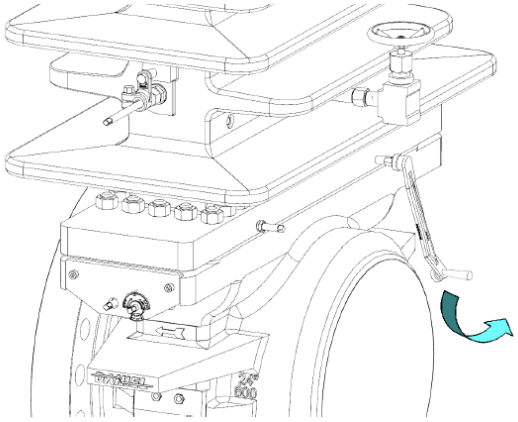


Figure 4-2: Step 1A



WARNING

PRESSURIZED FLUID HAZARD

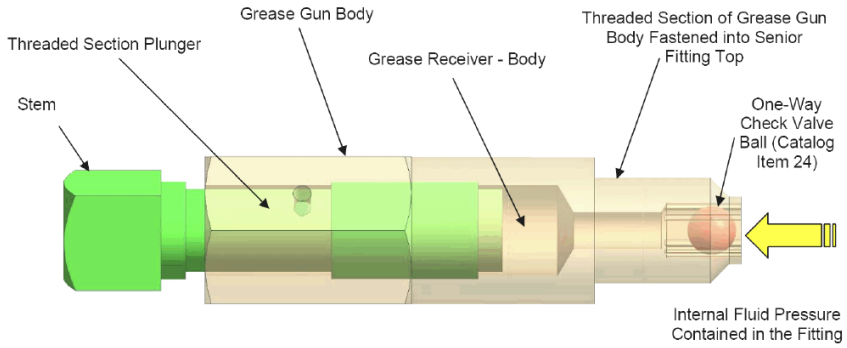
Using the Grease Gun (23), inject grease into the slide valve seat channels at a rate of 4 to 6 turns per minute and only under the following conditions:

- Bleeder Valve is open.
- Sealing bar/Clamping bar is in place and tight.

Injection of the grease at a faster rate will lead to the separation of the valve strip from the valve seat, resulting in release of pressurized fluid which may cause death or serious injury.

2. Return the stem to the Grease Gun (23) and begin turning it clockwise by hand into the Grease Gun (23) until resistance is felt. Once this is done, use the supplied Operating Wrench (2) to continue to turn the stem at a rate of 4 to 6 turns per minute.

Figure 4-3: Step 2



Grease Gun (23)

Important
By turning the stem of the Grease Gun (23) at a rate of 4 to 6 turns per minute, the lubricant is forced through the Slide Valve Seat (18) channels at a rate that allows the lubricant to travel freely, yet not separate the valve strip from the valve seat. This method will keep fresh grease in the lubrication passages.

3. Close Bleeder Valve (10F).

4.1.3 Component exercise

Prerequisites

In order to perform the maintenance operation described in this section, the following component exercise start check list must be met:

- The slide valve must be in the "CLOSED" position,
- The Bleeder Valve (10F) must be in the "CLOSED" position.
- The Equalizer Valve (1) must be in the "OPEN" position.

At this point the fluid pressure in the Top (14) will equal the fluid pressure in the Body (4).

Procedure

1. If the differential pressure is greater than 200 inches of H O, reduce the differential pressure across the meter to a maximum of (200 inches of H O) 7.2 psig.
2. Rotate the Upper Plate Carrier Shaft (7) located in the Top (14) several times in both directions. The Shaft (7) should turn freely.

3. Rotate the Slide Valve Shaft (5) in one direction until it stops. Then rotate the Slide Valve Shaft (5) in the opposite direction until it stops. Repeat this sequence several times. The slide valve should travel freely in both directions with light resistance. Leave the slide valve in the OPEN position.

Important
The following operation will affect the flowing differential and will be shown on any chart or instrument, keep records of differential, unless these instruments are isolated.

4. Rotate the Lower Plate Carrier Shaft (6), located in the Body (4), one turn to raise the Plate Carrier (8DM).
5. Rotate the Lower Plate Carrier Shaft (6) one turn in the opposite direction to lower the Plate Carrier (8DM).
   This operation raises and lowers the Plate Carrier (8DM) in and out of the flow stream. An initially high resistance to turning will be encountered when the Orifice plate (13) seal (see "Senior Orifice Fitting Technical Guide: DAN-DIF-TG-11-1003") is loosened from the Senior seal surface. Resistance to turning will also be present when the Plate Carrier (8DM) is lowered into its measurement position again.
6. Return the Plate Carrier (8DM) to the fully seated position in the Body (4).
7. Close the slide valve and close the Equalizer Valve (1).

WARNING
PRESSURIZED FLUID HAZARD
When opening the bleeder valve (10F) or venting the Top (14) through the bleeder valve (10F), direct the released pressurized fluid away from any individual in accordance with local environment regulations to a safe area.

The bleeder valve (10F) releases pressurized fluid that may cause contamination and/or accumulation of volatile gas mixtures. Failure to comply may cause death or serious injury.

8. Open the Bleeder Valve (10F) to vent the Top (14).
   Steps 9 and 10 are ONLY required for the Seniors equipped with grease assisted, metal-to-metal slide valves. Personnel operating the Seniors equipped with O-ring seal "soft seat" design slide valves, skip to step 11.
9. Remove the stem from the Grease Gun (23) with the Operating Wrench (2) and insert a lubricant stick into the Grease Gun (23).

WARNING
PRESSURIZED FLUID HAZARD
Using the Grease Gun (23), inject grease into the slide valve seat channels at a rate of 4 to 6 turns per minute and only under the following conditions:

- Bleeder Valve is open.
- Sealing bar/Clamping bar is in place and tight.

Injection of the grease at a faster rate will lead to the separation of the valve strip from the valve seat, resulting in release of pressurized fluid which may cause death or serious injury.

10. Return the stem to the Grease Gun (23) and begin turning the stem by hand into the Grease Gun (23) until resistance is felt. When resistance is felt, apply the Operating Wrench (2) to the Grease Gun (23) and continue to turn the stem into the Grease Gun (23) at a rate of 4 to 6 turns per minute until a seal is achieved.

    Important
    By turning the stem of the Grease Gun (23) at a rate of 4 to 6 turns per minute, the lubricant is forced through the Slide Valve Seat (18) channels at a rate that allows the lubricant to travel freely, yet not separate the valve strip from the valve seat. This method will keep fresh grease in the lubrication passages.

    If the addition of grease does not reduce the flow from the open Bleeder Valve (10F) to zero, follow these steps:

    - Close the Bleeder Valve (10F),
    - Open the Equalizer Valve (1), and move the Slide Valve Shaft (5) from the CLOSED to the OPEN position, and back to the CLOSED position, repeating this action several times.
    - Return the Slide Valve Shaft (5) back to the CLOSED position.
    - Close the Equalizer Valve (1) and repeat the lubrication process.
    - Open the Bleeder Valve (10F).

    If leakage is still present, close the Bleeder Valve (10F) and leave the Slide Valve Shaft (5) in the CLOSED position and schedule maintenance on the Senior.

11. Close the Bleeder Valve (10F).

    If at any point during the exercise of the components, the resistance encountered when turning a shaft is greater than the torque applied by hand using the Wrench (2), further inspection of the Senior is required.

4.2 Orifice plate installation and removal instructions

4.2.1 Plate change procedure overview

Follow these instructions during every plate change.

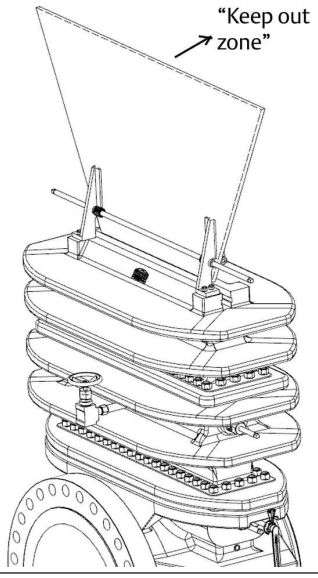
DANGER
FLUID EXPLOSION HAZARD
Follow the instructions below to avoid inadvertent or accidental opening of the slide valve and the propulsion of fluid or internal components from the Top (14).

Failure to comply will result in death or serious injury.

Never place any part of your body over the plate carrier slot opening (refer to Figure 4-4) of the Top (14) when the Sealing Bar Gasket (9A, 9A -HP or 9CF), the Sealing Bar (9 or 9HP) and the Clamping Bar (12 or 12HP) are removed from the Daniel Senior Orifice Fitting and the line is under pressure.

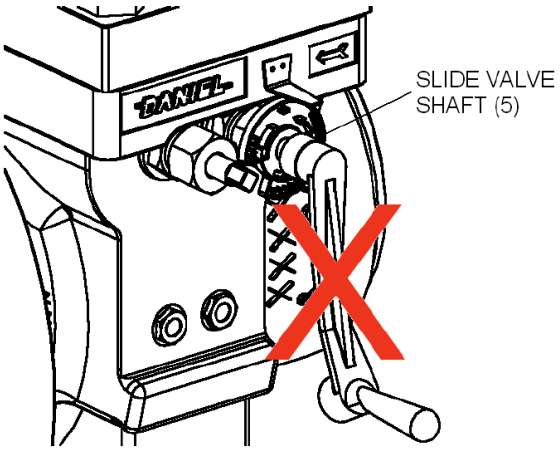
Never place the Operating Wrench (2) on the Slide Valve Shaft (5) (refer to Figure 4-5) when the Sealing Bar Gasket (9A, 9A-HP or 9CF), the Sealing Bar (9 or 9HP) and the Clamping Bar (12 or 12HP) are removed from the Senior and the line is under pressure.

Figure 4-4: Top (14) KEEP OUT ZONE (2)



(2) *Daniel Senior Orifice Fitting shown in vertical position. The KEEP OUT ZONE includes the plate carrier slot opening of the Top (14) even when the Senior is positioned horizontally (laying on its side).*

Figure 4-5: Improper Location of Operating Wrench (2) During an Orifice Plate Change Operation



4.2.2 Selecting an appropriate plate change procedure

WARNING

EXPLOSION HAZARD

The Daniel Senior Orifice Fitting contains fluid at elevated pressure. Ensure to follow the instructions below for proper installation and removal of the plate.

Failure to comply can cause an explosive release and may result in death or serious injury.

Important

In order to perform a safe and efficient plate change operation with a Senior, the on-site personnel must evaluate both the service and environmental conditions prior to beginning this operation. These conditions may have a dramatic effect on the time required for an operator's ability to return the Senior to its measurement condition.

As stated in the product description section of this manual, the Seniors utilize a "dual chamber" design. A slide valve contains the line pressure in the Body (4) during the plate extraction from the Senior and plate installation into the Senior. Daniel offers both an O-Ring seal "softseat" slide valve design, and a grease assisted, metal-to-metal slide valve design. Both designs ensure the optimum seal performance during this stage in the Orifice Plate (13) change. Under some service conditions, the grease used in the metal-to-metal slide valve design may migrate into the Top (14). If this was to occur, then the grease assisted metal-to-metal slide valve may not perform optimally and leakage will occur.

There are some services where, based on the characteristics of the fluid within and an intimate knowledge of the system, an operator and owner may allow some leakage past the slide valve during a plate change operation. This decision to allow leakage should be made on a case by case basis and be properly documented, communicated to, and acknowledged by, all personnel involved in the plate change operation. The sole responsibility for a decision to allow leakage lies with both the product owner and product operator. Daniel recommends that owners and operators use either the "Quick Change" or "Extended Time" methods described in this section.

Therefore, when performing an Orifice Plate (13) change on a Senior equipped with a grease assisted, metal-to-metal slide valve, Daniel recommends that at no time shall an operator leave the Sealing Bar (9 or 9HP), the Sealing Bar Gasket (9A, 9A-HP or 9CF), and the Clamping Bar (12 or 12HP) unfastened from the Top (14) except to remove and replace the Orifice Plate Carrier (8DM or 8DMC) from the Senior.

Finally, the operator should never leave any Senior, O-ring seal "soft-seat" slide valve design, or a grease assisted, metal-to-metal slide valve design, unattended while the Sealing Bar (9 or 9HP), the Sealing Bar Gasket (9A, 9A-HP or 9CF), and the Clamping Bar (12 or 12HP) are unfastened and removed from the Top (14).

In order to assist the operator in determining the safest and most efficient means to perform the Orifice Plate (13) change on a Senior equipped with a grease assisted slide valve, Daniel prepared two plate change procedures that an operator may select from.

The operator must select the appropriate procedure based upon their intimate knowledge of both the service and environmental conditions of that particular flow measurement system. The two Orifice Plate (13) change procedures described below are the "Quick Change" process, and the "Extended Time" process. If the Senior is equipped with a "soft-seat" slide valve design, then the operator may use either procedure.

An operator can select the "Quick Change" process, based upon their determination that it will take LESS THAN 15 MINUTES from the time the Top (14) fluid is evacuated to the full replacement of the Clamping Bar (12 or 12HP), the Sealing Bar (9 or 9HP), and the Sealing Bar Gasket (9A, 9A-HP or 9CF) after the plate change.

The "Extended Time" process is a procedure selected when the operator determines that the time beginning with the evacuation of Top (14) fluid to the full replacement of the Clamping Bar (12 or 12HP), the Sealing Bar (9 or 9HP), and the Sealing Bar Gasket (9A, 9A-HP or 9CF) after plate change is GREATER THAN 15 MINUTES.

If the operator does not know the time required to perform the Orifice Plate (13) change operation, then the operator must use the "Extended Time" procedure. The table below describes the conditions along with the suitable procedure.

Table 4-1: Plate change procedure selection for grease assisted slide valves and soft seat slide valves

Operator's evaluation of plate change conditions	Procedure	Type of valve
The estimated time period from the Top (14) fluid evacuation to the full replacement of the Clamping Bar (12 or 12HP), the Sealing Bar (9 or 9HP), and the Sealing Bar Gasket (9A, 9A-HP or 9CF) after plate change is: **LESS THAN 15 MINUTES**	"Quick Change"	Grease assisted slide valve or Soft seat slide valve
The estimated time period from the Top (14) fluid evacuation to the full replacement of the Clamping Bar (12 or 12HP), the Sealing Bar (9 or 9HP), and the Sealing Bar Gasket (9A, 9A-HP or 9CF) after plate change is: **GREATER THAN 15 MINUTES**	"Extended Time"	Grease assisted slide valve or Soft seat slide valve
The estimated time period from the Top (14) fluid evacuation to the full replacement of the Clamping Bar (12 or 12HP), the Sealing Bar (9 or 9HP), and the Sealing Bar Gasket (9A, 9A-HP or 9CF) after plate change is: **UNKNOWN**	"Extended Time"	Grease assisted slide valve or Soft seat slide valve

4.2.3 Orifice plate change operation

Important
In order to perform a safe and efficient plate change operation with a Senior, the on-site personnel must evaluate both the service and environmental conditions prior to beginning this operation. These conditions may have a dramatic effect on the time required for an operator's ability to return the Senior to its measurement condition.

The Daniel Senior Orifice Fitting's Top (14) is designed to temporarily hold the Plate Carrier (8DM or 8DMC) during plate change operations.

An operator controlled, grease assisted, slide valve separates the Top (14) from the line pressure to ensure optimum sealing performance. The slide valve grease used to achieve this performance may migrate into the Top (14) during the plate change operation. If this was to occur, the slide valve may not perform optimally and may leak.

The grease migration process is both time and environmental condition dependent. Therefore, Daniel offers two plate change procedures that an operator may choose from in order to perform this process in the safest and most efficient manner. These procedures are the "Quick Change" process and the "Extended Time" process.

The "Quick Change" process is a procedure based upon the operator's knowledge that the entire Orifice Plate (13) removal and installment, the time spent from the Top (14) fluid evacuation to the full replacement of the Clamping Bar (12 or 12HP), the Sealing Bar (9 or 9HP), and the Sealing Bar Gasket (9A, 9A-HP or 9CF) is under fifteen (15) minutes. The "Extended Time" process is a procedure based upon the operator's knowledge that the entire Orifice Plate (13) removal and installment, the time spent from the Top (14) fluid evacuation to the full replacement of the Clamping Bar (12 or 12HP), the Sealing Bar (9 or 9HP), and the Sealing Bar Gasket (9A, 9A-HP or 9CF) is over fifteen (15) minutes.

The procedural differences between these two processes are that, once the Plate Carrier (8DM or 8DMC) is extracted from the Senior, the "Extended Time" process requires the operator to place a new Sealing Bar Gasket (9A, 9A-HP or 9CF) along with replacing the Sealing Bar (9 or 9HP)/Clamping Bar (12 or 12HP) on the Top (14). Additionally, the operator is required to add grease to the Senior prior to removing the Sealing Bar (9 or 9HP)/Clamping Bar (12 or 12HP) in order to reinsert the Plate Carrier (8DM or 8DMC) assembly.

For "Soft Seat" equipped Seniors the operator may use either the "Quick Change" or the "Extended Time" plate removal procedures based upon the immediate service and environmental conditions encountered.

Daniel recommends either the "Quick Change" or the "Extended Time" plate orientation process for users of Seniors equipped with lubricated slide valves. Both the "Quick Change" and the "Extended Time" plate removal processes are provided for users of the Daniel Senior Orifice Fittings with lubricated slide valves.

Requirements for “Quick change” procedure

Pre-requisites

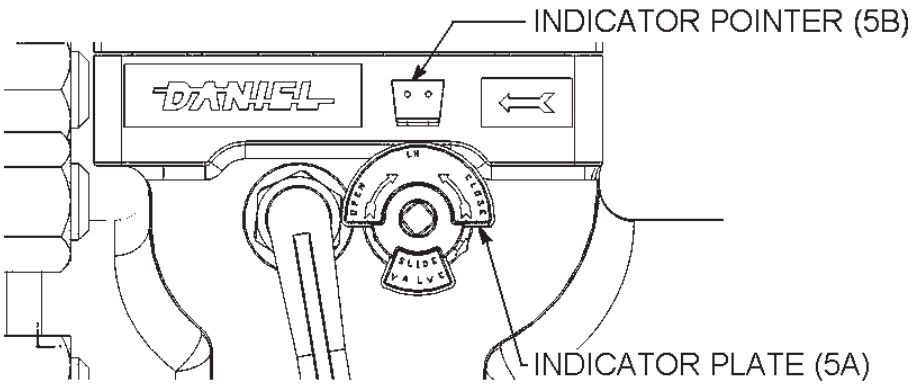
You may use the Quick change procedure for Daniel Senior Orifice Fittings equipped with an O-ring (10E) soft seated valve and for Seniors equipped with a grease-assisted slide valve.

Important
Do not use this procedure if it cannot be finished in less than 15 minutes.

WARNING
TOXIC EXPLOSION HAZARD
Do not perform any of the following steps if the Indicator Plate, the Indicator Pointer, or both are not assembled on the Senior. Call Flow Lifecycle Services for Daniel products for assistance in obtaining replacement components, and follow the instructions provided in Commission the Daniel Senior Orifice Fitting.

Improper installation, maintenance or removal could result in explosive or toxic conditions resulting in death or serious injury.

Figure 4-6: Indicator Plate (5A) and Pointer (5B)



NOTICE

Prior to performing any maintenance or Orifice Plate (13) installation and removal operations on the Senior, personnel must visually confirm the presence of the indicator Plate (5A) on the Slide Valve Shaft (5) and the Indicator Pointer (5B) on the Body (4). Both the indicator plate and the indicator pointer must be installed to operate this equipment safely.

In preparation for the plate removal and installation process, the operator must evaluate the meter system to determine the amount of time between the Top (14) fluid evacuation and the plate change to the full replacement of the Clamping Bar (12 or 12HP), the Sealing Bar (9 or 9HP), and the Sealing Bar Gasket (9A, 9A-HP or 9CF) back on the Top (14).

If the operator determines that the time between the Top (14) fluid evacuation and plate change to the full replacement of the Clamping Bar (12 or 12HP), the Sealing Bar (9 or 9HP), and the Sealing Bar Gasket (9A, 9A-HP or 9CF) back on the Top (14) is less than 15 minutes, then the operator may use the "QUICK CHANGE" procedure.

If the operator determines that the time between the Top (14) fluid evacuation and the plate change to the full replacement of the Clamping Bar (12 or 12HP), the Sealing Bar (9 or 9HP), and the Sealing Bar Gasket (9A, 9A-HP or 9CF) back on the Top (14) is greater than 15 minutes, then the operator must use the "EXTENDED TIME" procedure.

If, for any reason, the operator cannot determine the total time between the Top (14) fluid evacuation and the plate change to the full replacement of the Clamping Bar (12 or 12HP), the Sealing Bar (9 or 9HP), and the Sealing Bar Gasket (9A, 9A-HP or 9CF) back on the Top (14), then the operator must use the "EXTENDED TIME" procedure.

DANGER

FLUID EXPLOSION HAZARD

Follow the instructions below to avoid inadvertent or accidental opening of the slide valve and the propulsion of fluid or internal components from the Top (14).

Failure to comply will result in death or serious injury.

The following are the conditions required to start the removal procedure of the orifice plate:

- The Senior is operating at line pressure.
- The Plate Carrier (8DM) is located in the measurement position within the Body (4).
- The Indicator Pointer (5B) and the Indicator Plate (5A) are installed on the Senior.
- The Slide Valve Shaft (5) is in the CLOSED position.
- The Equalizer Valve (1) is in the CLOSED position.
- The Bleeder Valve (10F) is in the CLOSED position.
- The Sealing Bar Gasket (9A, 9A-HP or 9CF), the Sealing Bar (9 or 9HP), and the Clamping Bar (12 or 12HP) are fastened to the Top (14).
- Process temperature and ambient temperature values are within range of grease charts.
- Process pressure values are within the range of grease charts.

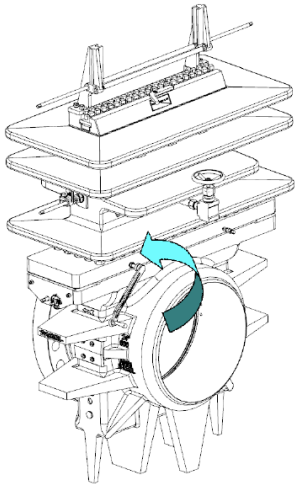
"Quick change" procedure

To remove the Orifice Plate (13) from the Senior, the operator must first balance the pressure between the Top (14) and the Body (4).

Procedure

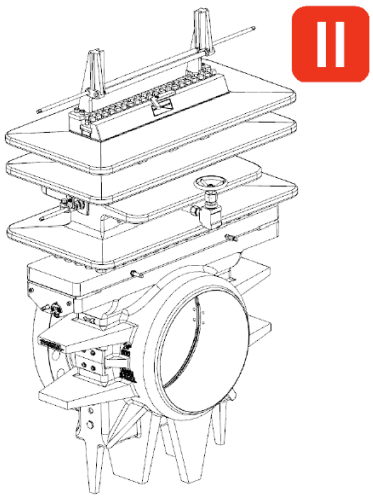
1. Open the Equalizer Valve (1) one half to two full turns using the Operating Wrench (2).

Figure 4-7: Step 1



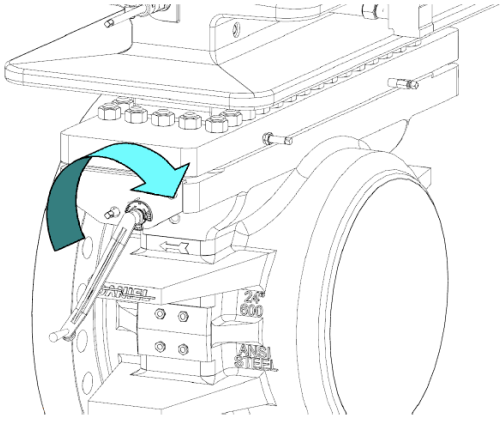
2. Wait several seconds while the pressure in the Top (14) equalizes to that of the Body (4).

Figure 4-8: Step 2



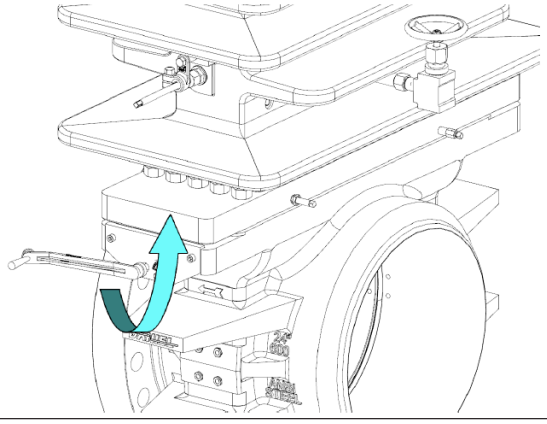
3. Using the Operating Wrench (2) rotate the Slide Valve Shaft (5) until it stops and the OPEN position specified on the Indicator Plate (5A) is in line with the Indicator Pointer (5B).

Figure 4-9: Step 3



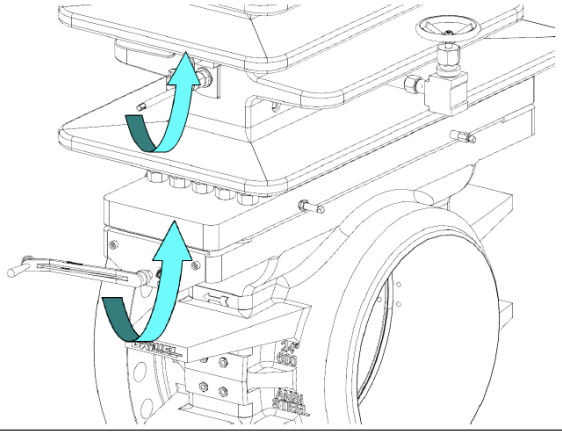
4. Rotate the Lower Plate Carrier Shaft (6), located on the Body (4), using the Operating Wrench (2) in a direction that will move the Plate Carrier (8DM or 8DMC) out of the Body (4) into the Top (14).

Figure 4-10: Step 4



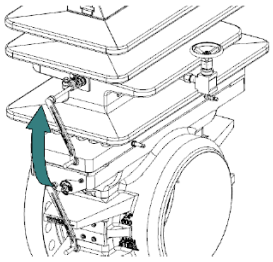
5. Continue to rotate the Lower Plate Carrier Shaft (6) located on the Body (4) until the Upper Plate Carrier Shaft (7) located in the Top (14) begins to rotate

Figure 4-11: Step 5



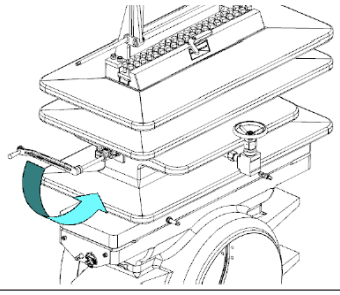
6. Move the Operating Wrench (2) from the Lower Plate Carrier Shaft (6) located in the Body (4) on the Upper Plate Carrier Shaft (7) located in the Top (14).

Figure 4-12: Step 6



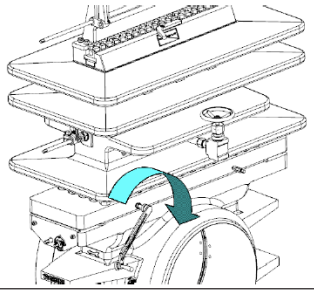
7. Rotate the Upper Plate Carrier Shaft (7) located in the Top (14) until the Plate Carrier (8DM or 8DMC) stops against the Sealing Bar (9, 9HP).

Figure 4-13: Step 7



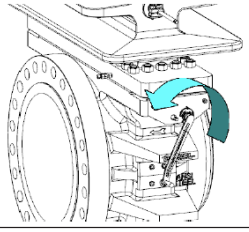
8. Close the Equalizer Valve (1) with the Operating Wrench (2).

Figure 4-14: Step 8



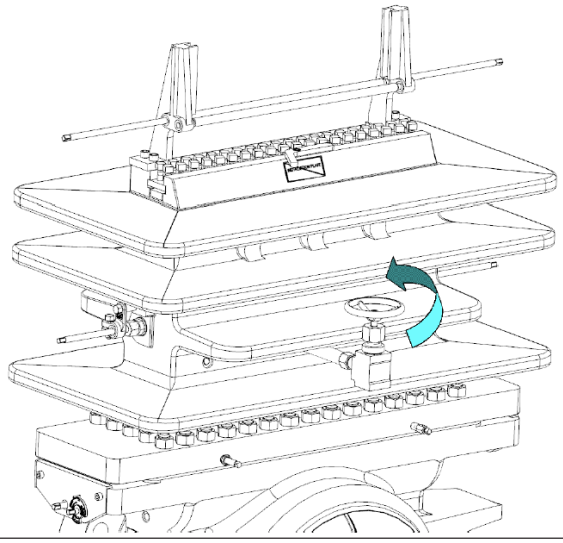
9. Using the Operating Wrench (2) rotate the Slide Valve Shaft (5) until it stops and the CLOSED position specified on the Indicator Plate (5A) is in line with the Indicator Pointer (5B).

Figure 4-15: Step 9



10. Open the Bleeder Valve (10B) with the Operating Wrench (2).

Figure 4-16: Step 10



WARNING

PRESSURIZED FLUID HAZARD

When opening the bleeder valve (10F) or venting the Top (14) through the bleeder valve (10F), direct the released pressurized fluid away from any individual in accordance with local environment regulations to a safe area.

The bleeder valve (10F) releases pressurized fluid that may cause contamination and/or accumulation of volatile gas mixtures. Failure to comply may cause death or serious injury.

NOTICE

The pressure contained in the Top (14) must be lowered to ambient pressure in order to begin any Orifice Plate (13) procedures. When lowering the pressure in the Top (14), the operator must direct fluid or gas escaping from the Top (14) to a safe area away from the operator, and in accordance with local environmental regulations.

Steps 11 and 12 are ONLY required for the Seniors equipped with grease assisted, metal-to-metal slide valves. Personnel operating the Senior equipped with O-ring seal "soft seat" design slide valves skip to step 13.

11. Remove the stem from the Grease Gun (23) with the Operating Wrench (2) and insert a lubricant stick into the Grease Gun (23).

Figure 4-17: Step 11

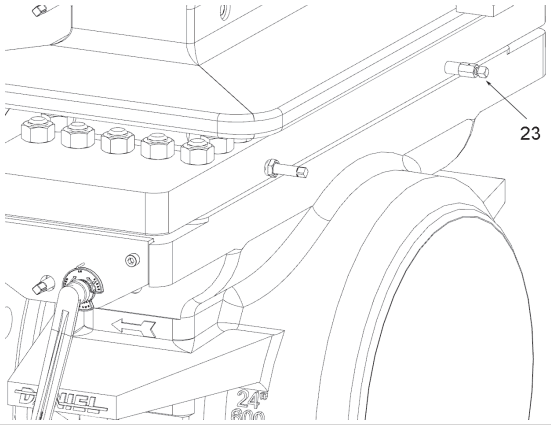
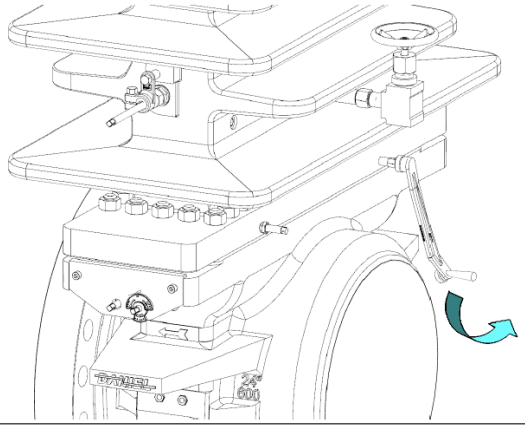


Figure 4-18: Step 11 A



WARNING

PRESSURIZED FLUID HAZARD

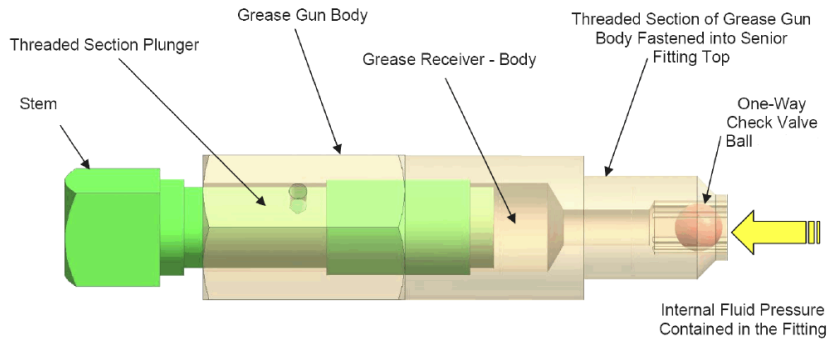
Using the Grease Gun (23), inject grease into the slide valve seat channels at a rate of 4 to 6 turns per minute and only under the following conditions:

- Bleeder Valve is open.
- Sealing bar/Clamping bar is in place and tight.

Injection of the grease at a faster rate will lead to the separation of the valve strip from the valve seat, resulting in release of pressurized fluid which may cause death or serious injury.

12. Return the stem to the Grease Gun (23) and begin turning it clockwise by hand into the Grease Gun (23) until resistance is felt. Once this is done, use the supplied Operating Wrench (2) to continue to turn the stem clockwise, at a rate of 4 to 6 turns per minute.

Figure 4-19: Step 12



Grease Gun (23)

Important

By turning the stem of the Grease Gun (23) at a rate of 4 to 6 turns per minute, the lubricant is forced through the Slide Valve Seat (18) channels at a rate that allows the lubricant to travel freely, yet not separate the valve strip from the valve seat. This method will keep fresh grease in the lubrication passages.

If the addition of grease does not reduce the flow from the open Bleeder Valve (10B) to zero, follow these steps:

- Close the Bleeder Valve (10B),
- Open the Equalizer Valve (1), and move the Slide Valve Shaft (5) from the CLOSED to the OPEN position, and back to the CLOSED position, repeating this action several times.
- Return the Slide Valve Shaft (5) back to the CLOSED position.
- Close the Equalizer Valve (1) and repeat the lubrication process.

- Open the Bleeder Valve (10B).

If leakage is still present, close the Bleeder Valve (10B) and leave the Slide Valve Shaft (5) in the CLOSED position and schedule maintenance on the Senior.

13. Monitor the fluid/gas pressure in the Top (14) until it is equal to ambient conditions.

Important
Once the Top (14) is equal to ambient conditions, the 15 minute countdown to remove and install the Orifice Plate Carrier (8DM) begins.

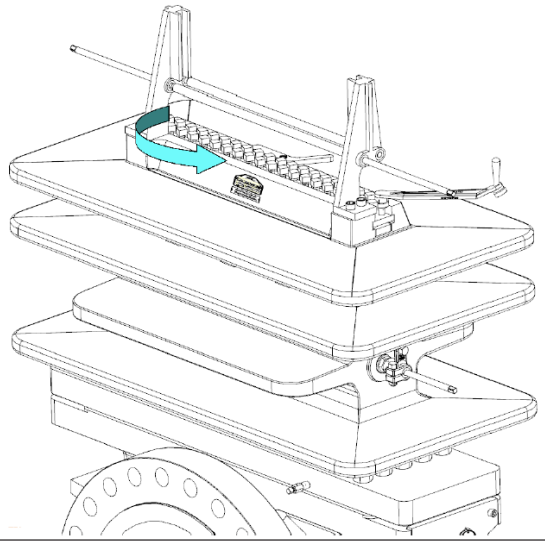
Although the fluid pressure contained in the Top (14) is reduced to ambient conditions in the following operations, there still remain remnants of the fluid in that chamber. The operator must employ a system to address the remaining fluid based upon the fluid's chemical composition and toxicity.

WARNING
RELEASE OF FLUIDS OR COMPONENTS HAZARD
The Clamping Bar (12 or 12HP) may not be securely in place. Sudden release of fluid or internal components may occur. Never place the Operating Wrench (2) on the Slide Valve Shaft (5), or any body part in front of the top opening in the Top (14).

Failure to comply may cause death or serious injury.

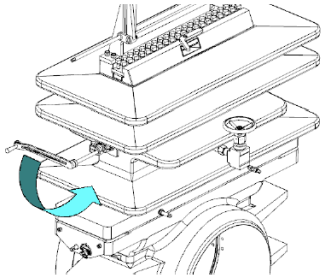
14. Loosen each Clamping Bar Screw (11) located on the Clamping Bar (12 or 12HP) approximately two turns with the Operating Wrench (2).

Figure 4-20: Step 14



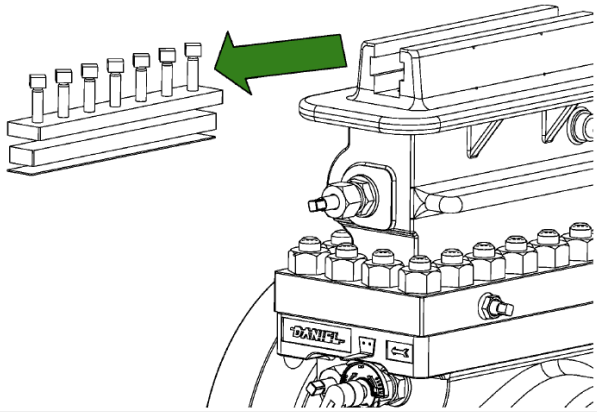
15. Once the Clamping Bar Screws (11) are loose, rotate the Upper Plate Carrier Shaft (7) located in the Top (14) with the Operating Wrench (2), until the Plate Carrier (8DM or 8DMC) taps against the Sealing Bar (9 or 9HP) freeing it from the Top (14).

Figure 4-21: Step 15



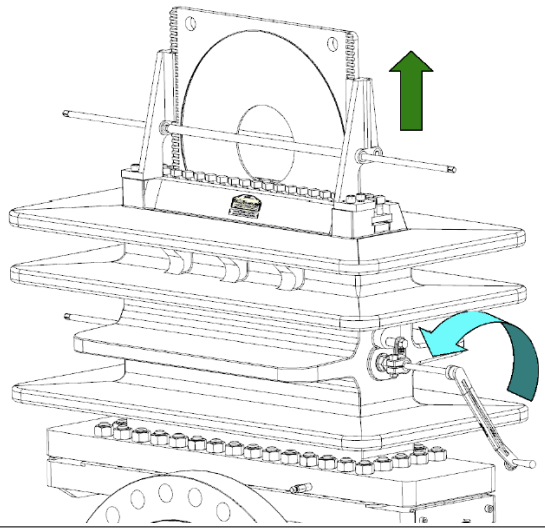
16. Slide the Clamping Bar (12 or 12HP) containing the Clamping Bar Screws (11), the Sealing Bar (9 or 9HP) from the Top (14).

Figure 4-22: Step 16-17



17. Remove the Sealing Bar Gasket (9A, 9A-HP or 9CF) from the Top (14).
18. Rotate the Upper Plate Carrier Shaft (7), located in the Top (14) with the Operating Wrench (2), until the Plate Carrier (8DM or 8DMC) extends outside of the Top (14) and continue to rotate the Upper Plate Carrier Shaft (7) until the Upper Plate Carrier Shaft (7) gears and the Plate Carrier (8DM or 8DMC) gear rack ratchet.

Figure 4-23: Step 18



19. Remove the Orifice Plate Carrier (8DM or 8DMC) from the Top (14) and perform the scheduled work on the Orifice Plate (13) and Orifice Plate Carrier (8DM or 8DMC).
20. Insert the Orifice Plate Carrier (8DM or 8DMC) into the Top (14) until the Upper Plate Carrier Shaft (7) gears and the plate carrier gear rack mesh.
21. With the Operating Wrench (2), rotate the Upper Plate Carrier Shaft (7), located in the Top (14), a minimum of one quarter turns OPPOSITE of the direction required to lower the Orifice Plate Carrier (8DM or 8DMC) into the Top (14). This action allows the Orifice Plate Carrier (8DM or 8DMC) to properly "align" the Orifice Plate Carrier (8DM or 8DMC) with the plate carrier shaft.

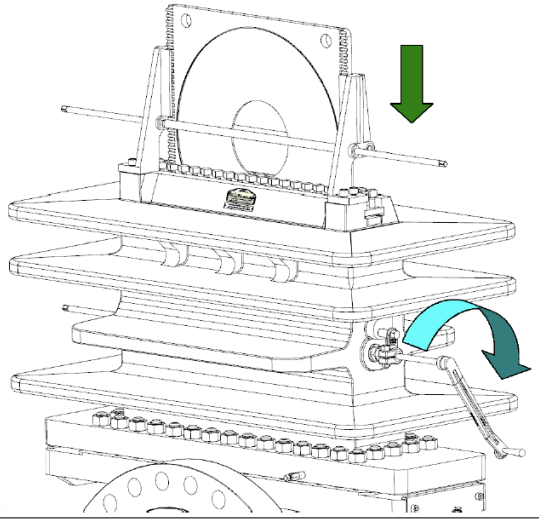
Important
Align the Orifice Plate Carrier (8DM or 8DMC) with the Upper Plate Carrier Shaft (7). Failure to do so may damage the Senior.

WARNING
PRESSURIZED FLUID HAZARD
Do not lower the Plate Carrier (8DM) directly onto the slide valve as it may damage the sealing features and release pressurized fluid.

Damaging the sealing features may cause contamination and/or accumulation of volatile gas mixtures, resulting in death or serious injury and equipment damage.

22. Once the Orifice Plate Carrier (8DM) is aligned, rotate the Upper Plate Carrier Shaft (7) with the Operating Wrench (2), in a direction to lower the Orifice Plate Carrier (8DM) into the Top (14) until all of the Orifice Plate Carrier (8DM) is below the Sealing Bar Gasket (9A) surface.

Figure 4-24: Step 22



WARNING

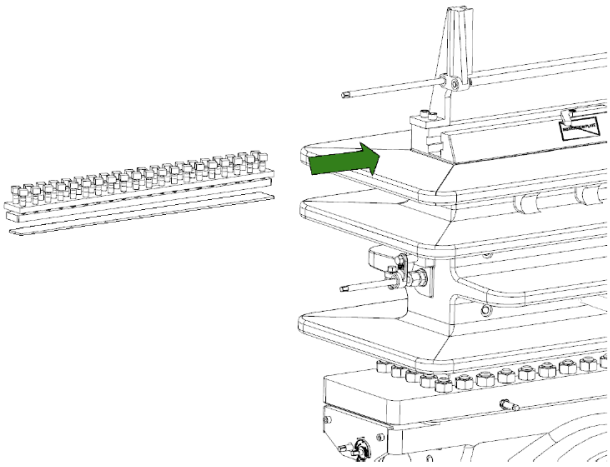
EXPLOSION HAZARD

Ensure that the Sealing Bar Gasket (9A, 9A-HP or 9CF), the Sealing Bar (9 or 9HP) and the Clamping Bar (12 or 12HP) provide a pressure barrier between the line pressure and the atmosphere.

Failure to properly install these parts may result in explosive separation of components resulting in death or serious injury.

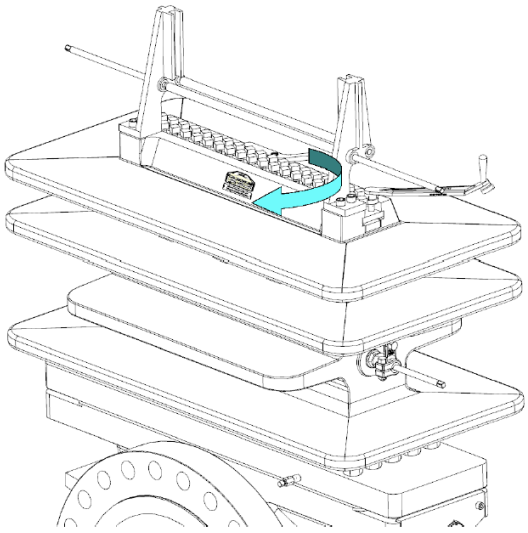
23. Install a new Sealing Bar Gasket (9A) on to the Top (14).

Figure 4-25: Step 23



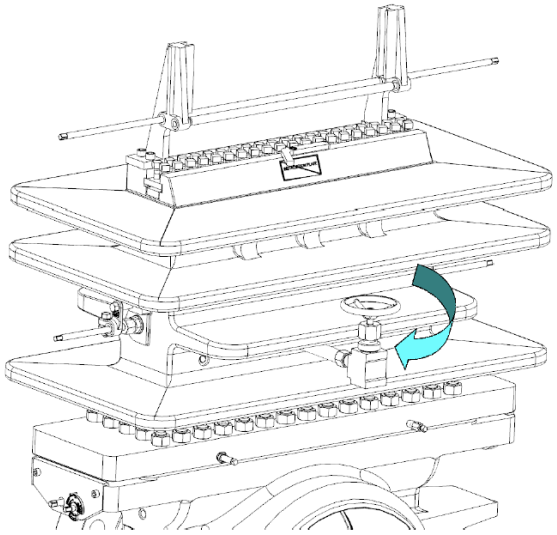
24. Install the Sealing Bar (9) and the Clamping Bar (12) on to the Top (14). 25.
25. Tighten each Clamping Bar Screw (11), located on the Clamping Bar (12), to the torque recommended in this manual (refer to Torque information).

Figure 4-26: Step 25



26. Close the Bleeder Valve (10F).

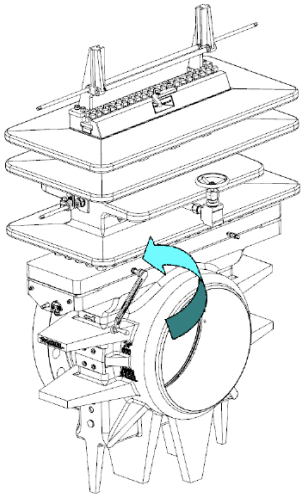
Figure 4-27: Step 26



Important
After closing the Bleeder Valve (10F), the 15 minute countdown to remove and install the Orifice Plate Carrier (8DM) ends.

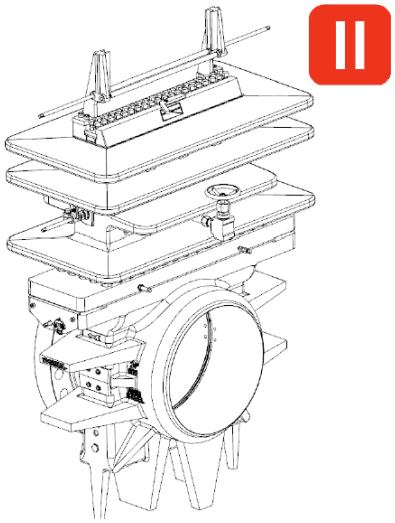
27. Open the Equalizer Valve (1) one-half to two turns with the Operating Wrench (2).

Figure 4-28: Step 27



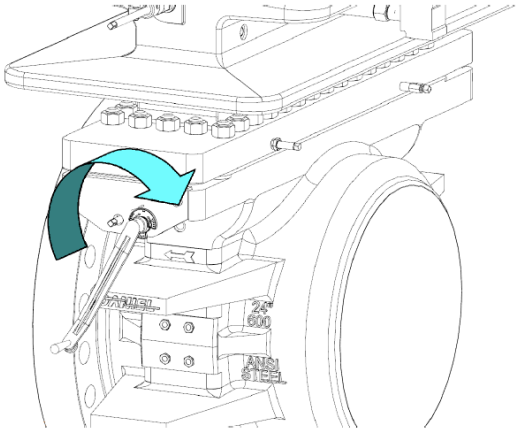
28. Wait several seconds for the Top (14) to reach pressure equilibrium with the line pressure contained in the Body (4).

Figure 4-29: Step 28



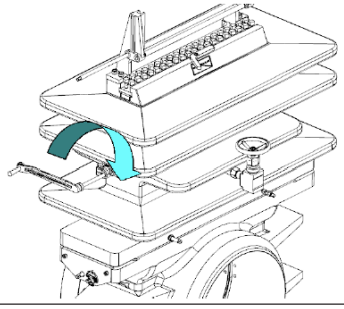
29. Using the Operating Wrench (2), rotate the Slide Valve Shaft (5) to the OPEN position.

Figure 4-30: Step 29



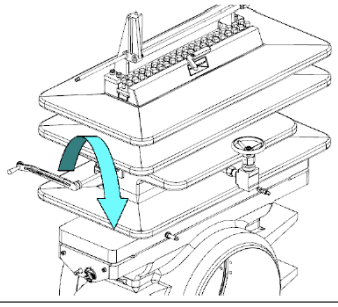
30. Rotate the Upper Plate Carrier Shaft (7) with the Operating Wrench (2) in the direction to lower the Orifice Plate Carrier (8DM) into the Body (4).

Figure 4-31: Step 30



31. Rotate the Lower Plate Carrier Shaft (6) with the Operating Wrench (2) until the Orifice Plate Carrier (8DM) cannot be lowered further.

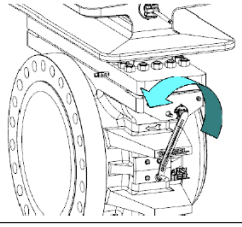
Figure 4-32: Step 31



Important
Resistance to turning will be present when the Orifice Plate Carrier (8DM) is approaching its proper measurement position due to friction between the fitting Body (4) and the Orifice Plate (13) seal.

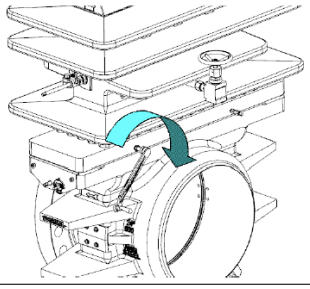
32. Once the Orifice Plate Carrier (8DM) is positioned in the Body (4), turn the Slide Valve Shaft (5) using the Operating Wrench (2) into the CLOSED position.

Figure 4-33: Step 32



33. Close the Equalizer Valve (1).

Figure 4-34: Step 33



WARNING

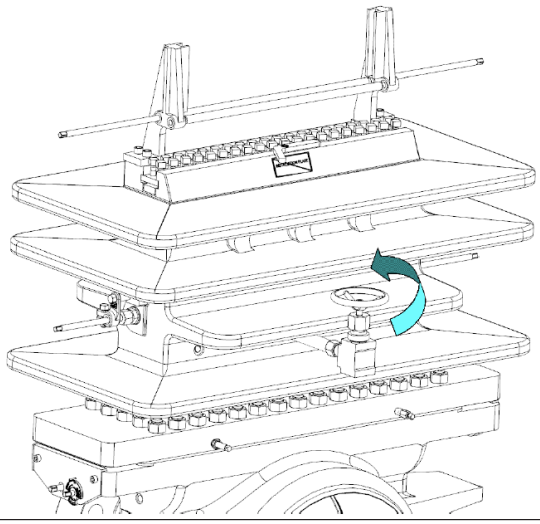
PRESSURIZED FLUID HAZARD

When opening the bleeder valve (10F) or venting the Top (14) through the bleeder valve (10F), direct the released pressurized fluid away from any individual in accordance with local environment regulations to a safe area.

The bleeder valve (10F) releases pressurized fluid that may cause contamination and/or accumulation of volatile gas mixtures. Failure to comply may cause death or serious injury.

34. Open the Bleeder Valve (10F) to vent the Top (14).

Figure 4-35: Step 34



Steps 35 and 36 are ONLY required for the Daniel Senior Orifice Fittings equipped with grease assisted, metal-to-metal slide valves. Personnel operating the Daniel Senior Orifice Fittings equipped with O-Ring seal “soft seat” design slide valves skip to step 37.

35. Remove the stem from the Grease Gun (23) with the Operating Wrench (2) and insert a Daniel lubricant stick into the Grease Gun (23).

Figure 4-36: Step 35

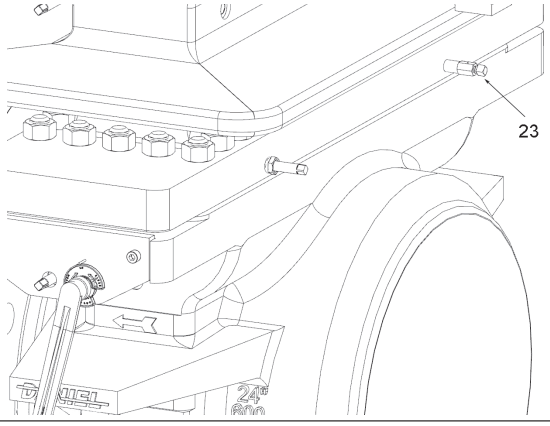
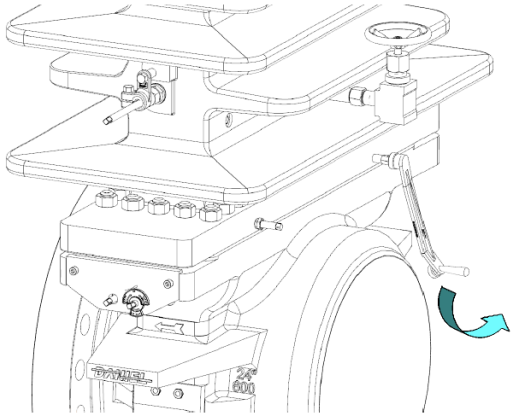


Figure 4-37: Step 35A



WARNING

PRESSURIZED FLUID HAZARD

Using the Grease Gun (23), inject grease into the slide valve seat channels at a rate of 4 to 6 turns per minute and only under the following conditions:

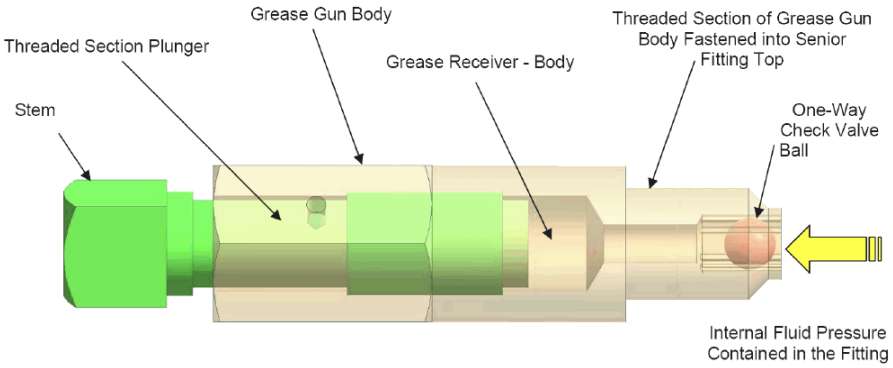
- Bleeder Valve is open.
- Sealing bar/Clamping bar is in place and tight.

Injection of the grease at a faster rate will lead to the separation of the valve strip from the valve seat, resulting in release of pressurized fluid which may cause death or serious injury.

36. Return the stem to the Grease Gun (23) and begin turning it clockwise by hand into the Grease Gun (23) until resistance is felt. Once this is done, use the supplied

Operating Wrench (2) to continue to turn the stem at a rate of 4 to 6 turns per minute.

Figure 4-38: Step 36



Grease Gun (23)

Important
By turning the stem of the Grease Gun (23) at a rate of 4 to 6 turns per minute, the lubricant is forced through the Slide Valve Seat (18) channels at a rate that allows the lubricant to travel freely, yet not separate the valve strip from the valve seat. This method will keep fresh grease in the lubrication passages.

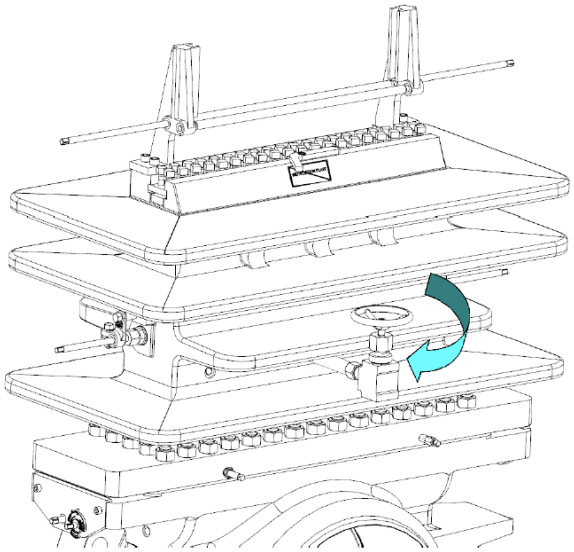
If the addition of grease does not reduce the flow from the open Bleeder Valve (10F) to zero, follow these steps:

- Close the Bleeder Valve (10F),
- Open the Equalizer Valve (1), and move the Slide Valve Shaft (5) from the CLOSED to the OPEN position, and back to the CLOSED position, repeating this action several times.
- Return the Slide Valve Shaft (5) back to the CLOSED position.
- Close the Equalizer Valve (1) and repeat the lubrication process.
- Open the Bleeder Valve (10F).

If leakage is still present, close the Bleeder Valve (10F) and leave the Slide Valve Shaft (5) in the CLOSED position and schedule maintenance on the Senior.

37. Close the Bleeder Valve (10F).

Figure 4-39: Step 37



The Daniel Senior Orifice Fitting is now ready for measurement.

Requirements for “Extended time” procedure

This procedure is for the grease-assisted slide valves when the procedure takes over 15 minutes. However, it is acceptable for soft-seated valves. For Seniors equipped with an O-Ring (10E) soft seated valve, the operator may employ either the "QUICK CHANGE" procedure or the "EXTENDED TIME" procedure. However, for the Seniors equipped with a grease-assisted slide valve, the "QUICK CHANGE" procedure may be used only if it can be finished in less than 15 minutes.

WARNING

TOXIC EXPLOSION HAZARD

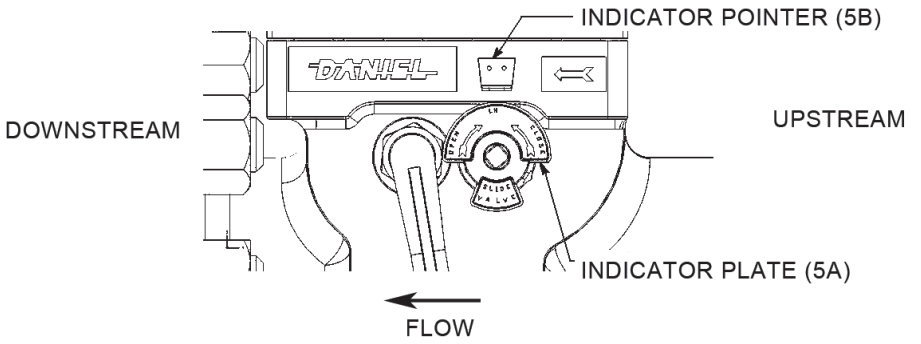
Do not perform any of the following steps if the Indicator Plate, the Indicator Pointer, or both are not assembled on the Senior. Call Flow Lifecycle Services for Daniel products for assistance in obtaining replacement components, and follow the instructions provided in Commission the Daniel Senior Orifice Fitting.

Improper installation, maintenance or removal could result in explosive or toxic conditions resulting in death or serious injury.

NOTICE

Prior to performing any maintenance or Orifice Plate (13) installation and removal operations on the Senior, personnel must visually confirm the presence of the indicator Plate (5A) on the Slide Valve Shaft (5) and the Indicator Pointer (5B) on the Body (4). Both the indicator plate and the indicator pointer must be installed to operate this equipment safely.

Figure 4-40: Indicator plate (5A) and pointer (5B)



In preparation for the plate removal and installation process, the operator must evaluate the meter system to determine the amount of time between the Top (14) fluid evacuation and the plate change to the full replacement of the Clamping Bar (12), the Sealing Bar (9), and the Sealing Bar Gasket (9A) back on the Top (14).

If the operator determines that the time between the Top (14) fluid evacuation and plate change to the full replacement of the Clamping Bar (12), the Sealing Bar (9), and the Sealing Bar Gasket (9A) back on the Top (14) is less than 15 minutes, then the operator may use the "QUICK CHANGE" procedure.

If the operator determines that the time between the Top (14) fluid evacuation and the plate change to the full replacement of the Clamping Bar (12), the Sealing Bar (9), and the Sealing Bar Gasket (9A) back on the Top (14) is greater than 15 minutes, then the operator must use the "EXTENDED TIME" procedure.

If, for any reason, the operator cannot determine the total time between the Top (14) fluid evacuation and the plate change to the full replacement of the Clamping Bar (12), the Sealing Bar (9), and the Sealing Bar Gasket (9A) back on the Top (14), then the operator must use the "EXTENDED TIME" procedure.

DANGER

FLUID EXPLOSION HAZARD

Follow the instructions below to avoid inadvertent or accidental opening of the slide valve and the propulsion of fluid or internal components from the Top (14).

Failure to comply will result in death or serious injury.

The following are the conditions required to start the removal procedure of the orifice plate:

- The Senior is operating at line pressure.
- The Plate Carrier (8DM) is located in the measurement position within the Body (4).
- The Indicator Pointer (5B) and the Indicator Plate (5A) are installed on the Senior.
- The Slide Valve Shaft (5) is in the CLOSED position.
- The Equalizer Valve (1) is in the CLOSED position.
- The Bleeder Valve (10F) is in the CLOSED position.

- The Sealing Bar Gasket (9A), the Sealing Bar (9), and the Clamping Bar (12) are fastened to the Top (14).
- Process temperature and ambient temperature values are within range of grease charts.
- Process pressure values are within the range of grease charts.

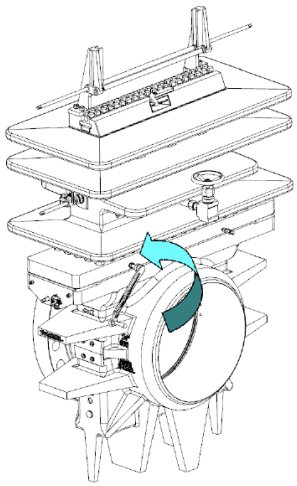
“Extended time” procedure

To remove the Orifice Plate (13) from the Daniel Senior Orifice Fitting, the operator must first balance the pressure between the Top (14) and the Body (4).

Procedure

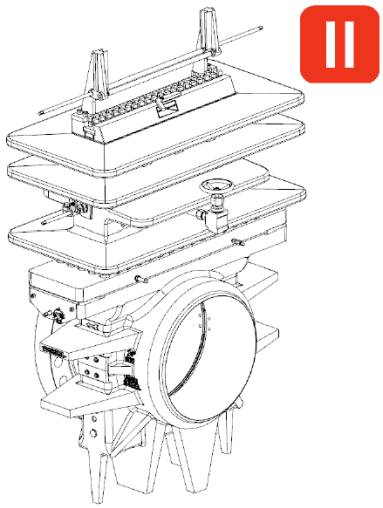
1. Open the Equalizer Valve (1) one half to two full turns using the Operating Wrench (2).

Figure 4-41: Step 1



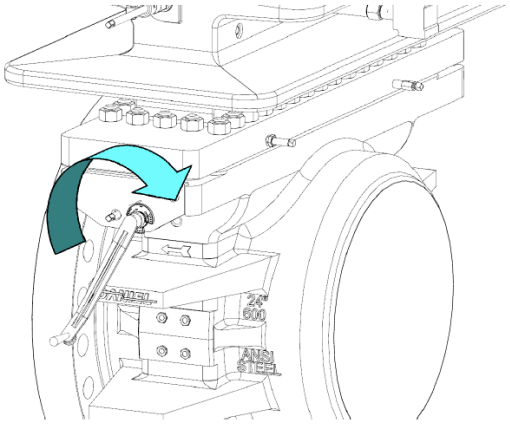
2. Wait several seconds while the pressure in the Top (14) equalizes to that of the Body (4).

Figure 4-42: Step 2



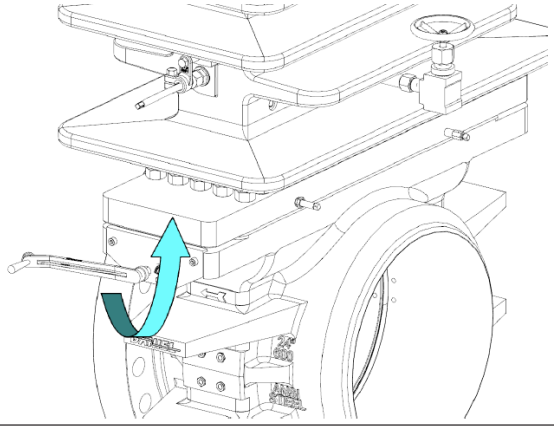
3. Using the Operating Wrench (2) rotate the Slide Valve Shaft (5) until it stops and the OPEN position is specified on the Indicator Plate (5A) with the Indicator Pointer (5B).

Figure 4-43: Step 3



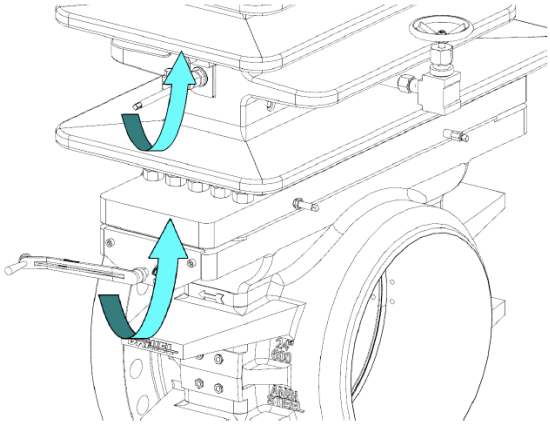
4. Rotate the Lower Plate Carrier Shaft (6) located on the Body (4) using the Operating Wrench (2) in a direction that will move the Plate Carrier (8DM) out of the Body (4) into the Top (14).

Figure 4-44: Step 4



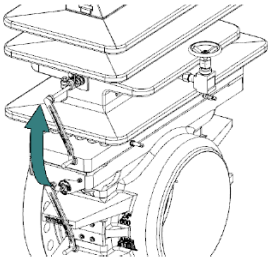
5. Continue to rotate the Lower Plate Carrier Shaft (6) located on the Body (4) until the Upper Plate Carrier Shaft (7) located in the Top (14) begins to rotate.

Figure 4-45: Step 5



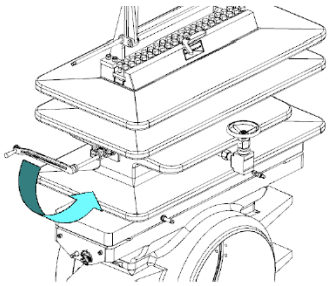
6. Move the Operating Wrench (2) from the Lower Plate Carrier Shaft (6) located in the Body (4) on the Upper Plate Carrier Shaft (7) located in the Top (14).

Figure 4-46: Step 6



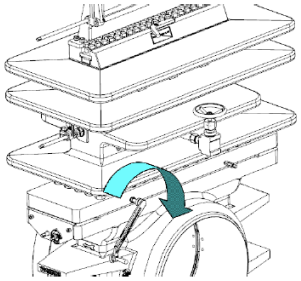
7. Rotate the Upper Plate Carrier Shaft (7) located in the Top (14) until the Plate Carrier (8DM) stops against the Sealing Bar (9).

Figure 4-47: Step 7



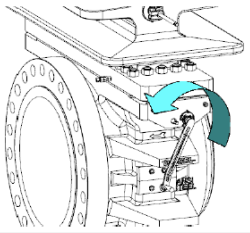
8. Close the Equalizer Valve (1) with the Operating Wrench (2).

Figure 4-48: Step 8



9. Using the Operating Wrench (2) rotate the Slide Valve Shaft (5) until it stops and the CLOSED position specified on the Indicator Plate (5A) is in line with the Indicator Pointer (5B).

Figure 4-49: Step 9



10. Open the Bleeder Valve.

WARNING

PRESSURIZED FLUID HAZARD

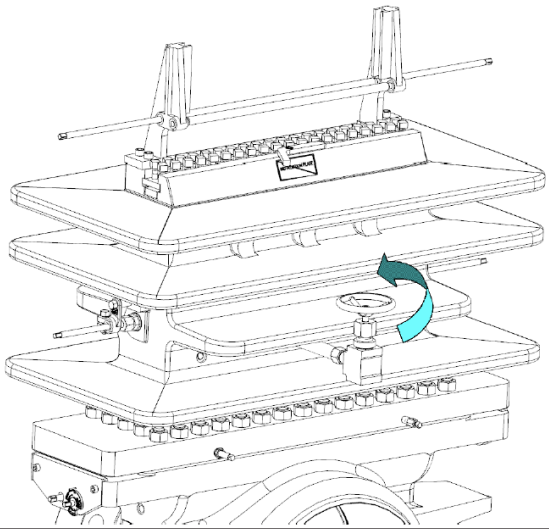
When opening the bleeder valve (10F) or venting the Top (14) through the bleeder valve (10F), direct the released pressurized fluid away from any individual in accordance with local environment regulations to a safe area.

The bleeder valve (10F) releases pressurized fluid that may cause contamination and/or accumulation of volatile gas mixtures. Failure to comply may cause death or serious injury.

NOTICE

The pressure contained in the Top (14) must be lowered to ambient pressure in order to begin any Orifice Plate (13) procedures. When lowering the pressure in the Top (14), the operator must direct fluid or gas escaping from the Top (14) to a safe area away from the operator, and in accordance with local environmental regulations.

Figure 4-50: Step 10



Steps 11 and 12 are ONLY required for the Seniors equipped with grease assisted, metal-tometal slide valves. Personnel operating the Senior equipped with O-Ring seal “soft seat” design slide valves skip to step 13.

11. Remove the stem from the Grease Gun (23) with the Operating Wrench (2) and insert a Daniel lubricant stick into the Grease Gun (23).

Figure 4-51: Step 11

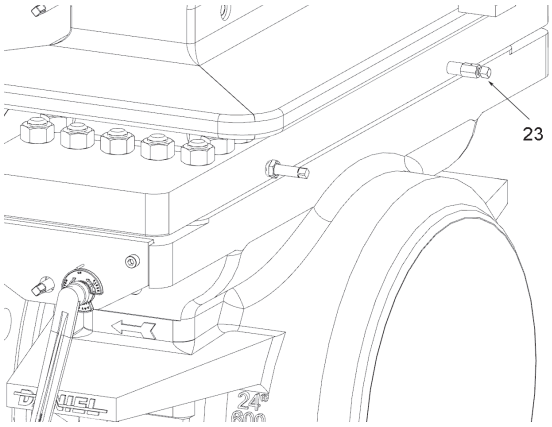
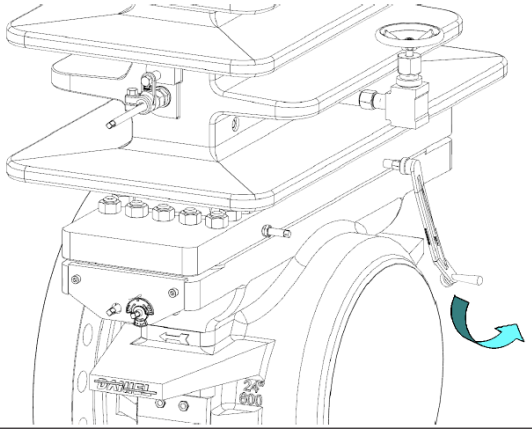


Figure 4-52: Step 11A



WARNING

PRESSURIZED FLUID HAZARD

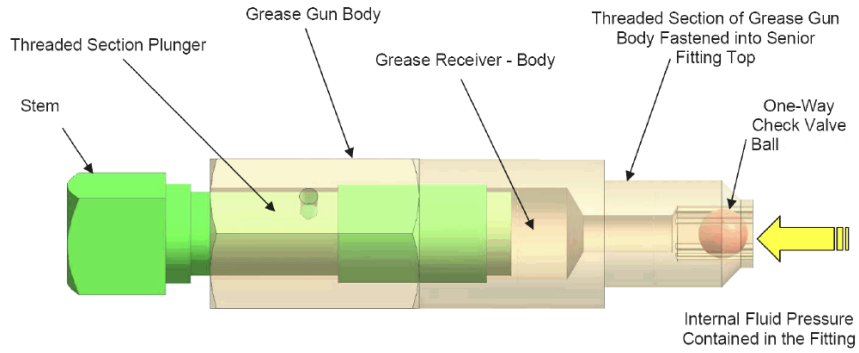
Using the Grease Gun (23), inject grease into the slide valve seat channels at a rate of 4 to 6 turns per minute and only under the following conditions:

- Bleeder Valve is open.
- Sealing bar/Clamping bar is in place and tight.

Injection of the grease at a faster rate will lead to the separation of the valve strip from the valve seat, resulting in release of pressurized fluid which may cause death or serious injury.

12. Return the stem to the Grease Gun (23) and begin turning it clockwise by hand into the Grease Gun (23) until resistance is felt. Once this is done, use the supplied Operating Wrench (2) to continue to turn the stem clockwise, at a rate of 4 to 6 turns per minute.

Figure 4-53: Step 12



Grease Gun (23)

Important

By turning the stem of the Grease Gun (23) at a rate of 4 to 6 turns per minute, the lubricant is forced through the Slide Valve Seat (18) channels at a rate that allows the lubricant to travel freely, yet not separate the valve strip from the valve seat. This method will keep fresh grease in the lubrication passages.

Although the fluid pressure contained in the Top (14) is reduced to ambient conditions in the following operations, remnants of the fluid still remain in that chamber. The operator must employ a system to address the remaining fluid based upon the fluids' chemical composition and toxicity.

13. Monitor the fluid/gas pressure in the Top (14) until it is equal to ambient conditions.

WARNING

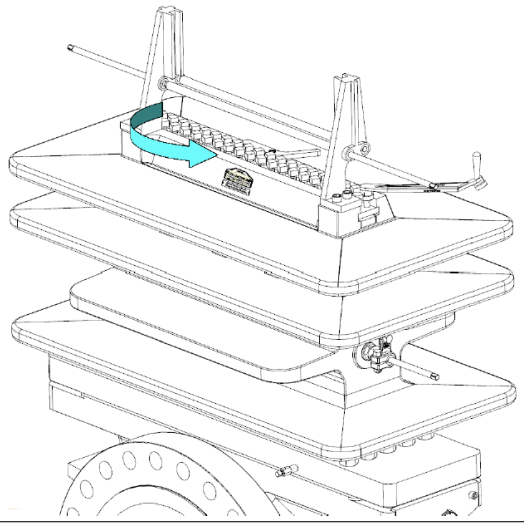
RELEASE OF FLUIDS OR COMPONENTS HAZARD

The Clamping Bar (12) may not be securely in place. Sudden release of fluid or internal components may occur. Never place the Operating Wrench (2) on the Slide Valve Shaft (5), or any body part in front of the top opening in the Top (14).

Failure to comply may cause death or serious injury.

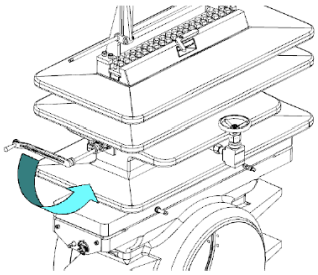
14. Loosen each Clamping Bar Screw (11) located on the Clamping Bar (12) approximately two turns with the Operating Wrench (2).

Figure 4-54: Step 14



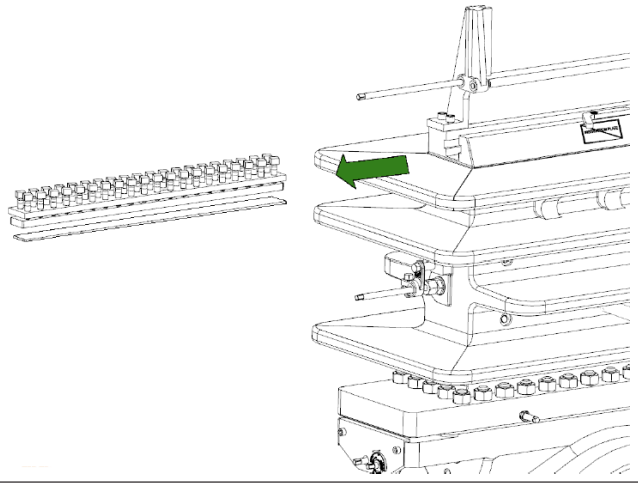
15. Once the Clamping Bar Screws (11) are loose, rotate the Upper Plate Carrier Shaft (7) located in the Top (14) with the Operating Wrench (2), until the Plate Carrier (8DM) taps against the Sealing Bar (9) freeing it from the Top (14).

Figure 4-55: Step 15



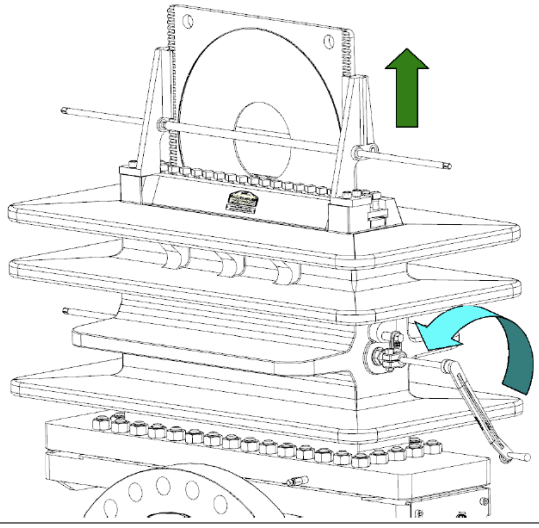
16. Slide the Clamping Bar (12) containing the Clamping Bar Screws (11), the Sealing Bar (9 or 9HP) from the Top (14).

Figure 4-56: Step 16-17



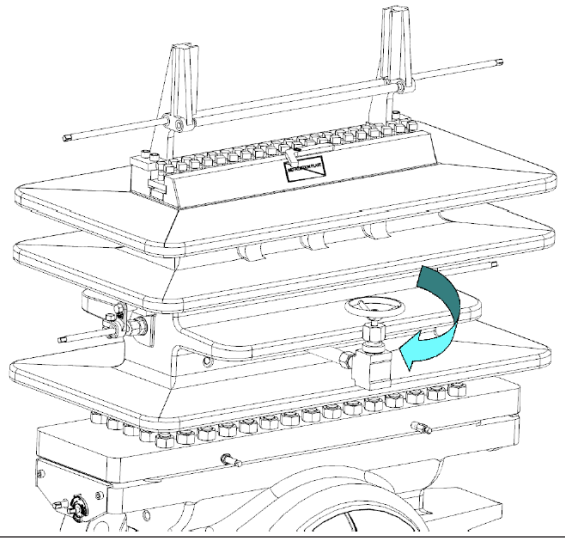
17. Remove the Sealing Bar Gasket (9A) from the Top (14).
18. Rotate the Upper Plate Carrier Shaft (7), located in the Top (14) with the Operating Wrench (2), until the Plate Carrier (8DM) extends outside of the Top (14) and continue to rotate the Upper Plate Carrier Shaft (7) until the Upper Plate Carrier Shaft (7) gears and the Plate Carrier (8DM) gear rack ratchet.

Figure 4-57: Step 18



19. Remove the Orifice Plate Carrier (8DM) from the Top (14) and perform the scheduled work on the Orifice Plate (13) and Orifice Plate Carrier (8DM).
20. Close the Bleeder Valve (10F).

Figure 4-58: Step 20



WARNING

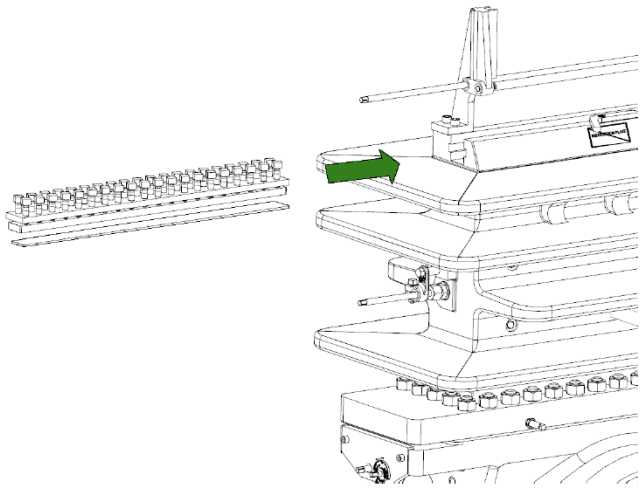
EXPLOSION HAZARD

Follow the instructions in this manual to assure that the Sealing Bar Gasket (9A), the Sealing Bar (9) and the Clamping Bar (12) provide a pressure barrier between the line pressure and the atmosphere.

Failure to properly install these parts may result in explosive separation of components resulting in death or serious injury.

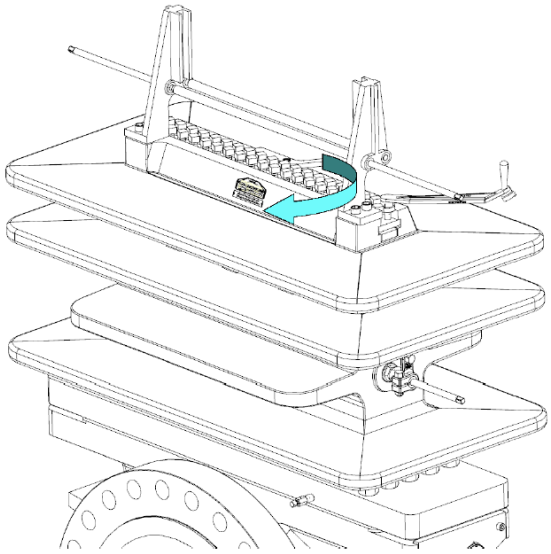
21. Immediately install a new Sealing Bar Gasket (9A) on the Top (14) along with the Sealing Bar (9) and the Clamping Bar (12).

Figure 4-59: Step 21



22. Tighten each Clamping Bar Screw (11) located on the Clamping Bar (12) to the torque recommended in this manual (refer to Torque information).

Figure 4-60: Step 22



Important

At this stage in the operational procedure, the Senior is at the following conditions:

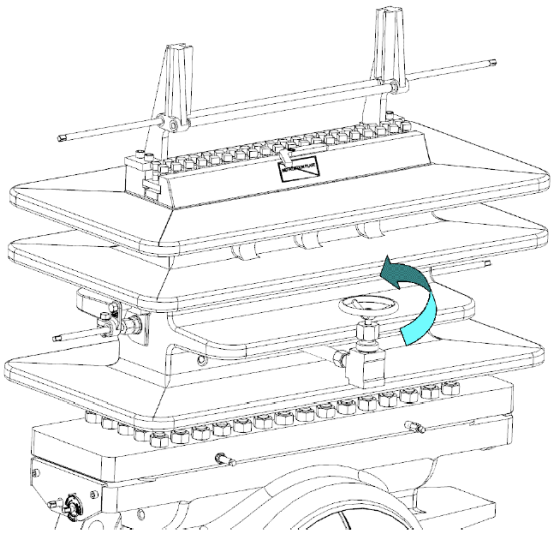
- The Equalizer Valve (1) is closed.
- The Bleeder Valve (10F) closed.
- The Slide Valve is closed.

- The Sealing Bar (9), the Clamping Bar (12), and a new Sealing Bar Gasket (9A are installed on the Top (14).

Therefore, the operator may now perform the scheduled work on the Orifice Plate (13) and the Orifice Plate Carrier (8DM) without time restriction.

23. Complete work on the Orifice Plate Carrier (8DM) and prepare the Senior for insertion of the Orifice Plate Carrier (8DM).
24. Open the Bleeder Valve (10F).

Figure 4-61: Step 24



WARNING

PRESSURIZED FLUID HAZARD

When opening the bleeder valve (10F) or venting the Top (14) through the bleeder valve (10F), direct the released pressurized fluid away from any individual in accordance with local environment regulations to a safe area.

The bleeder valve (10F) releases pressurized fluid that may cause contamination and/or accumulation of volatile gas mixtures. Failure to comply may cause death or serious injury.

NOTICE

The pressure contained in the Top (14) must be lowered to ambient pressure in order to begin any Orifice Plate (13) procedures. When lowering the pressure in the Top (14), the operator must direct fluid or gas escaping from the Top (14) to a safe area away from the operator, and in accordance with local environmental regulations.

Steps 24 and 25 are ONLY required for the Seniors equipped with grease assisted, metal-tometal slide valves. Personnel operating Seniors equipped with O-Ring seal “soft seat” design slide valves skip to step 26.

25. Remove the stem from the Grease Gun (23) with the Operating Wrench (2) and insert a Daniel lubricant stick into the Grease Gun (23).

Figure 4-62: Step 25

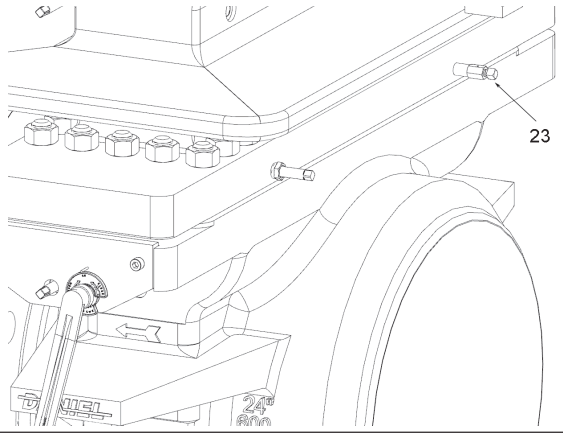
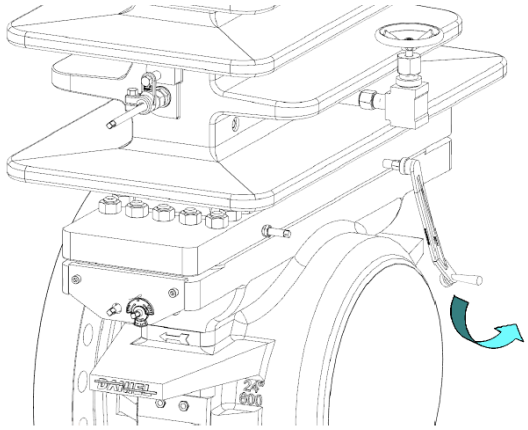


Figure 4-63: Step 25A



26. Return the stem to the Grease Gun (23) and begin turning it clockwise by hand into the Grease Gun (23) until resistance is felt. Once this is done, use the supplied Operating Wrench (2) to continue to turn the stem at a rate of 4 to 6 turns per minute.

WARNING

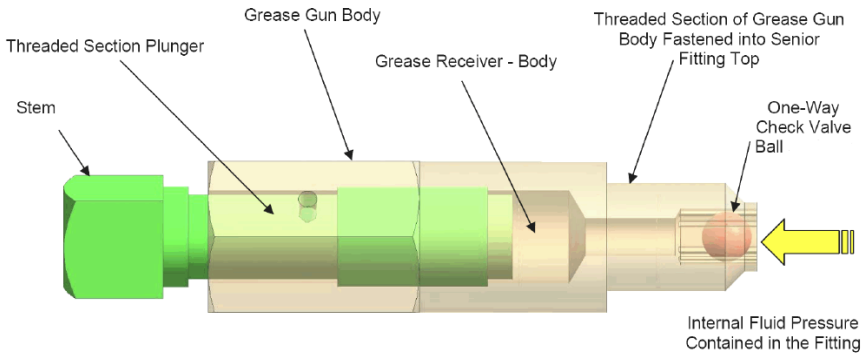
PRESSURIZED FLUID HAZARD

Using the Grease Gun (23), inject grease into the slide valve seat channels at a rate of 4 to 6 turns per minute and only under the following conditions:

- Bleeder Valve is open.
- Sealing bar/Clamping bar is in place and tight.

Injection of the grease at a faster rate will lead to the separation of the valve strip from the valve seat, resulting in release of pressurized fluid which may cause death or serious injury.

Figure 4-64: Step 26



Grease Gun (23)

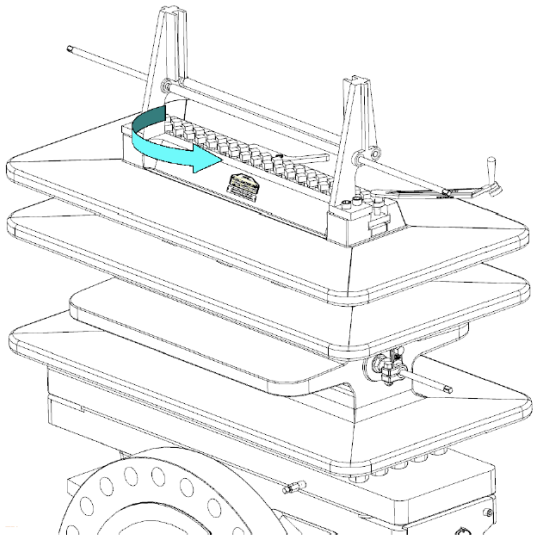
Important

By turning the stem of the Grease Gun (23) at a rate of 4 to 6 turns per minute, the lubricant is forced through the Slide Valve Seat (18) channels at a rate that allows the lubricant to travel freely, yet not separate the valve strip from the valve seat. This method will keep fresh grease in the lubrication passages.

Although the fluid pressure contained in the Top (14) is reduced to ambient conditions in the following operations, remnants of the fluid still remain in that chamber. The operator must employ a system to address the remaining fluid based upon the fluids' chemical composition and toxicity.

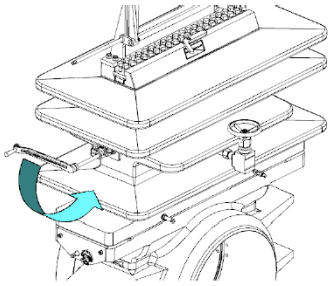
27. Monitor the fluid/gas pressure in the Top (14) to ensure that it is equal to ambient conditions.
28. Loosen each Clamping Bar Screw (11) located on the Clamping Bar (12) approximately two turns with the Operating Wrench (2).

Figure 4-65: Step 28



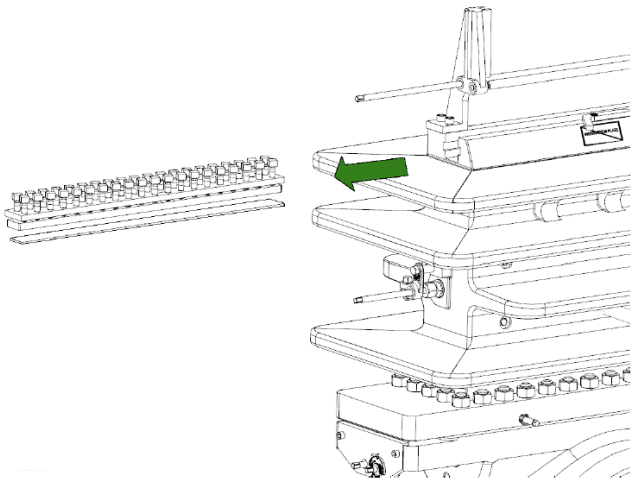
29. Once the Clamping Bar Screws (11) are loose, it may be necessary to use the Operating Wrench (2) to tap against the Sealing Bar (9) freeing it from the Top (14).

Figure 4-66: Step 29



30. Slide the Clamping Bar (12) containing the Clamping Bar Screws (11), the Sealing Bar (9) from the Top (14).

Figure 4-67: Step 30-31



31. Remove the Sealing Bar Gasket (9A) from the Top (14).
32. Insert the Orifice Plate Carrier (8DM) into the Top (14) until the Upper Plate Carrier Shaft (7) gears and plate carrier gear rack mesh.
33. With the Operating Wrench (2), rotate the Upper Plate Carrier Shaft (7), located in the Top (14), a minimum of one quarter turns OPPOSITE of the direction required to lower the Orifice Plate Carrier (8DM) into the Top (14). This action allows the Orifice Plate Carrier (8DM) to properly "align" the Orifice Plate Carrier (8DM) with the plate carrier shaft.

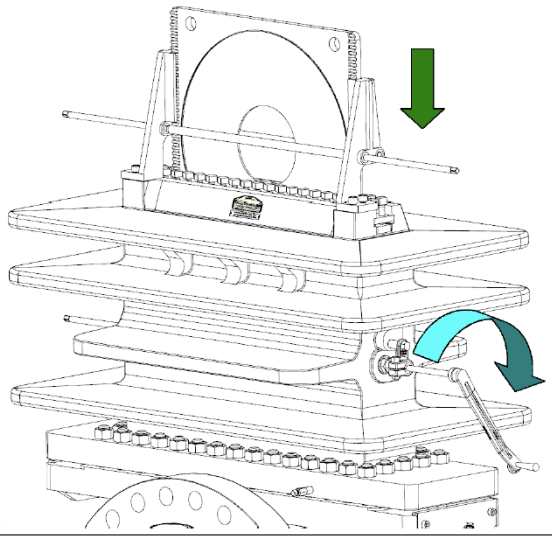
Important
Align the Orifice Plate Carrier (8DM) with the Upper Plate Carrier Shaft (7). Failure to do so may damage the Senior.

WARNING
PRESSURIZED FLUID HAZARD
When opening the bleeder valve (10F) or venting the Top (14) through the bleeder valve (10F), direct the released pressurized fluid away from any individual in accordance with local environment regulations to a safe area.

The bleeder valve (10F) releases pressurized fluid that may cause contamination and/or accumulation of volatile gas mixtures. Failure to comply may cause death or serious injury.

34. Once the Orifice Plate Carrier (8DM) is aligned, rotate the Upper Plate Carrier Shaft (7) with the Operating Wrench (2), in a direction to lower the Orifice Plate Carrier (8DM) into the Top (14) until all of the Orifice Plate Carrier (8DM) is below the Sealing Bar Gasket (9A) surface.

Figure 4-68: Step 34



WARNING

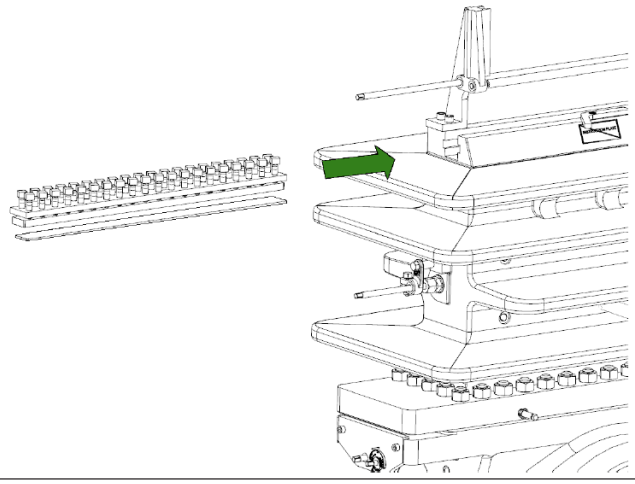
EXPLOSION HAZARD

Follow the instructions in this manual to assure that the Sealing Bar Gasket (9A), the Sealing Bar (9) and the Clamping Bar (12) provide a pressure barrier between the line pressure and the atmosphere.

Failure to properly install these parts may result in explosive separation of components resulting in death or serious injury.

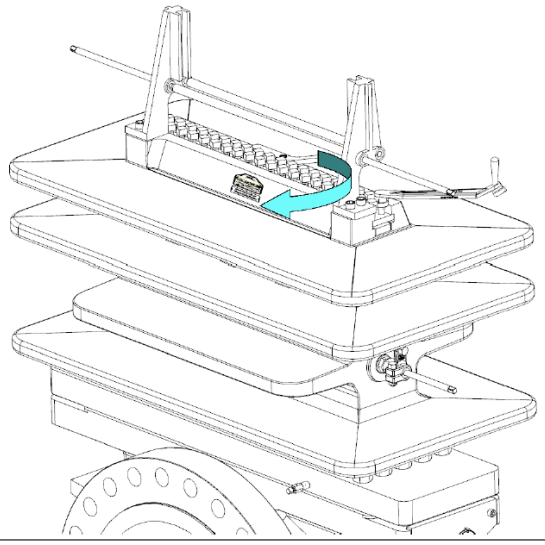
35. Install a new Sealing Bar Gasket (9A) on to the Top (14).

Figure 4-69: Step 35-36



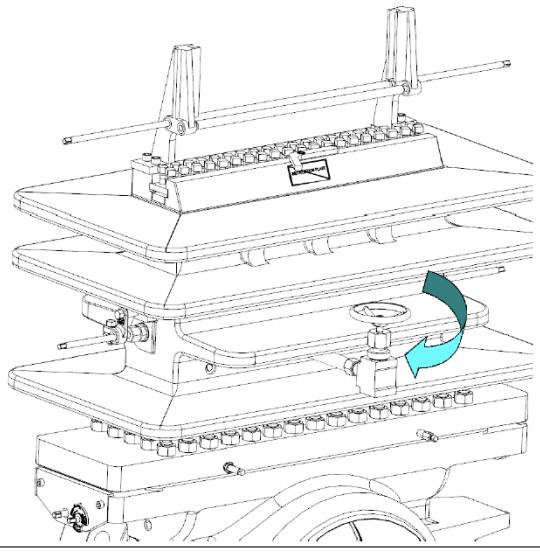
36. Install the Sealing Bar (9) and the Clamping Bar (12) on to the Top (14).
37. Tighten each Clamping Bar Screw (11), located on the Clamping Bar (12), to the torque recommended in this manual (refer to Torque information)

Figure 4-70: Step 37



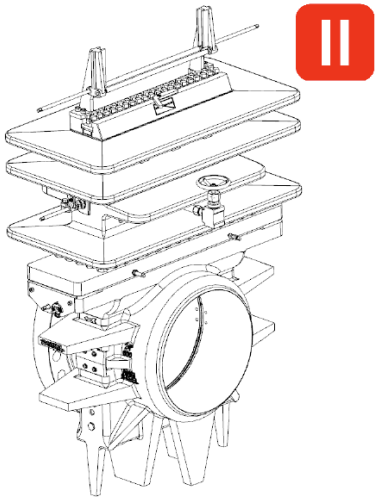
38. Close the Bleeder Valve (10F).

Figure 4-71: Step 38



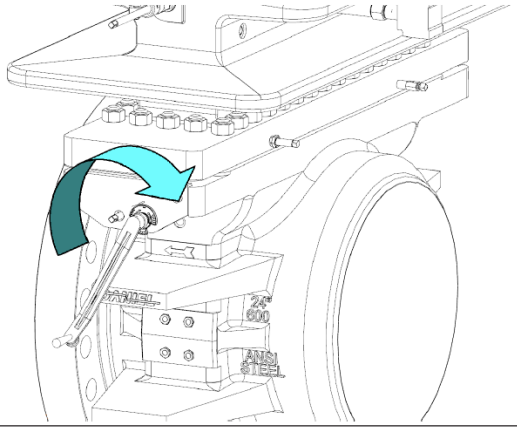
39. Open the Equalizer Valve (1) one-half to two turns with the Operating Wrench (2).
40. Wait several seconds for the Top (14) to reach pressure equilibrium with the line pressure contained in the Body (4).

Figure 4-72: Step 40



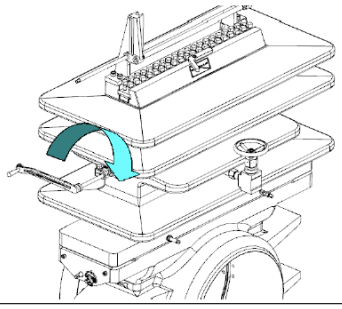
41. Using the Operating Wrench (2), rotate the Slide Valve Shaft (5) to the OPEN position.

Figure 4-73: Step 41



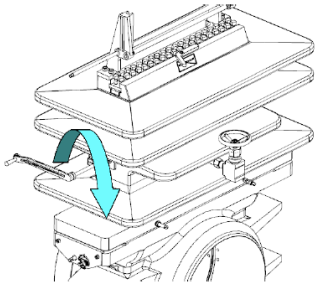
42. Rotate the Upper Plate Carrier Shaft (7) located in the Top (14) with the Operating Wrench (2) in the direction to lower the Orifice Plate Carrier (8DM) into the Body (4).

Figure 4-74: Step 42



43. Rotate the Lower Plate Carrier Shaft (6) with the Operating Wrench (2) until the Orifice Plate Carrier (8DM) cannot be lowered further.

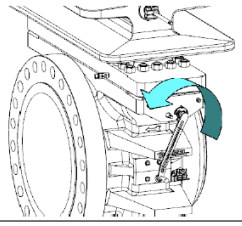
Figure 4-75: Step 43



Important
Resistance to turning will be present when the Orifice Plate Carrier (8DM) is approaching its proper measurement position due to friction between the fitting Body (4) and the Orifice Plate (13) seal.

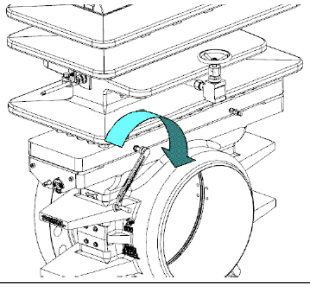
44. Once the Orifice Plate Carrier (8DM) is positioned in the Body (4), turn the Slide Valve Shaft (5) using the Operating Wrench (2) into the CLOSED position.

Figure 4-76: Step 44



45. Close the Equalizer Valve (1).

Figure 4-77: Step 45

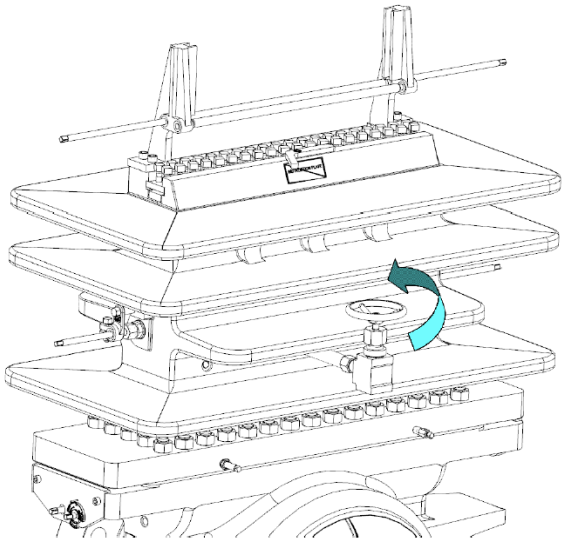


WARNING
PRESSURIZED FLUID HAZARD
When opening the bleeder valve (10F) or venting the Top (14) through the bleeder valve (10F), direct the released pressurized fluid away from any individual in accordance with local environment regulations to a safe area.

The bleeder valve (10F) releases pressurized fluid that may cause contamination and/or accumulation of volatile gas mixtures. Failure to comply may cause death or serious injury.

46. Open the Bleeder Valve (10F) to vent the Top (14).

Figure 4-78: Step 46



Step 47 and 48 are ONLY required for Seniors equipped with grease assisted, metal-to-metal slide valves. Personnel operating the Daniel Senior Orifice Fitting equipped with O-Ring seal “soft seat” design slide valves skip to step 49.

47. Remove the stem from the Grease Gun (23) with the Operating Wrench (2) and insert a Daniel lubricant stick into the Grease Gun (23).

Figure 4-79: Step 47

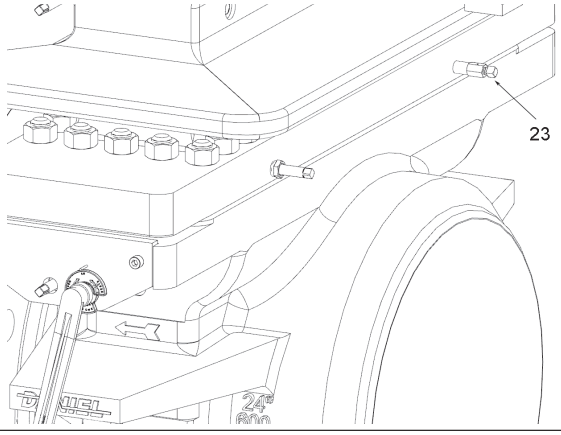
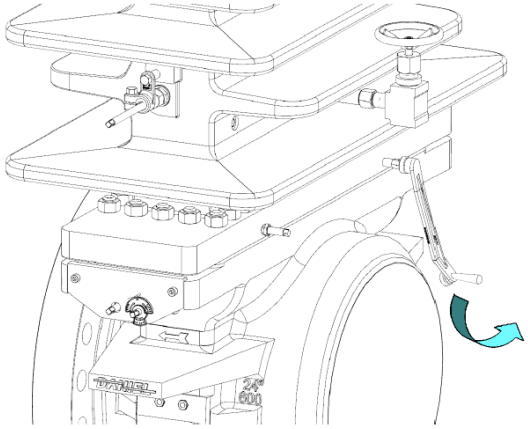


Figure 4-80: Step 47A



WARNING

PRESSURIZED FLUID HAZARD

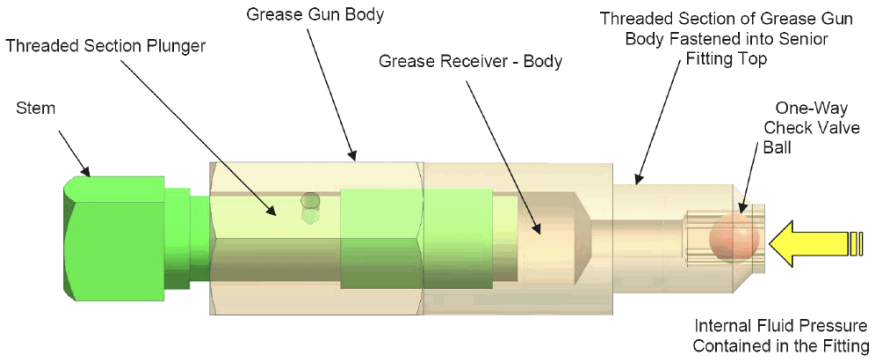
Using the Grease Gun (23), inject grease into the slide valve seat channels at a rate of 4 to 6 turns per minute and only under the following conditions:

- Bleeder Valve is open.
- Sealing bar/Clamping bar is in place and tight.

Injection of the grease at a faster rate will lead to the separation of the valve strip from the valve seat, resulting in release of pressurized fluid which may cause death or serious injury.

48. Return the stem to the Grease Gun (23) and begin turning it clockwise by hand into the Grease Gun (23) until resistance is felt. Once this is done, use the supplied Operating Wrench (2) to continue to turn the stem at a rate of 4 to 6 turns per minute.

Figure 4-81: Step 48



Grease Gun (23)

Important
By turning the stem of the Grease Gun (23) at a rate of 4 to 6 turns per minute, the lubricant is forced through the Slide Valve Seat (18) channels at a rate that allows the lubricant to travel freely, yet not separate the valve strip from the valve seat. This method will keep fresh grease in the lubrication passages.

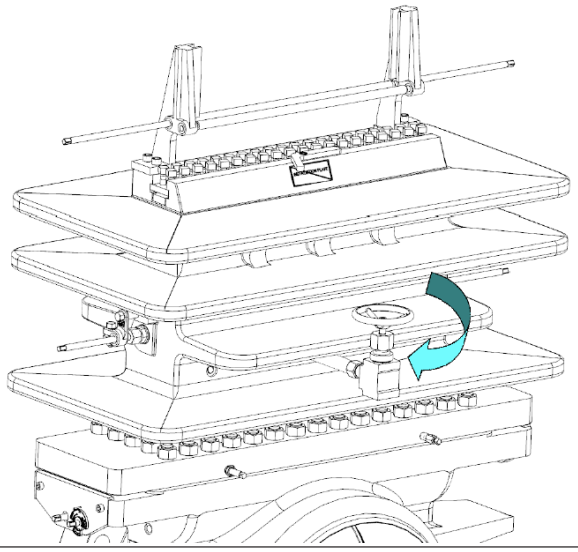
If the addition of grease does not reduce the flow from the open Bleeder Valve (10F) to zero, follow these steps:

- Close the Bleeder Valve (10F)
- Open the Equalizer Valve (1), and move the Slide Valve Shaft (5) from the CLOSED to the OPEN position, and back to the CLOSED position, repeating this action several times.
- Return the Slide Valve Shaft (5) back to the CLOSED position.
- Close the Equalizer Valve (1) and repeat the lubrication process.
- Open the Bleeder Valve (10F).

If leakage is still present, close the Bleeder Valve (10F) and leave the Slide Valve Shaft (5) in the CLOSED position and schedule maintenance on the Senior.

49. Close the Bleeder Valve (10F).

Figure 4-82: Step 49



The Daniel Senior Orifice Fitting is now ready for measurement.

5 Supplemental information

5.1 Recommended spare parts for a one-year operation

Table 5-1: Recommended spare parts

Item No.	Daniel	Description	Material	Quantity
5	150-2500	Shaft	CS (ZP)	1
8E	150-600	Orifice Plate Sealing Unit	Nitrile	5
8TS	900-2500	Orifice Plate Sealing Unit	PTFE	3
9A	150-900	Sealing Bar Gasket	Composition	5
11	150-2500	Clamping Bar Screws	Alloy Steel, (ZP)	2
18A	150-900	Slide Valve Seat/Top Gasket	Composition	1
18A	1500	Slide Valve Seat/Top Gasket	Composition	1
14CF	1500	Body/Top Gasket (o-ring)	Special Compound	1
14CF-A	2500	Body/Top Gasket	Parker Seal	1
22A	150-1500	Stuffing Box/ Bearing Plug Gasket	SS	2
22A	2500	Stuffing Box/ Bearing Plug Gasket	SS	2
22B	2500	Stuffing Box/ Bearing Plug O-Ring	Nitrile	2
25A	150-1500	Packing Rings	PTFE	1-SET
25A-HP	2500	Packing Rings	PTFE	1-SET
25B	2500	Centering Rings	PTFE	1-SET
25B-HP	150-1500	Centering Rings	PTFE	1-SET
26C	2500	External Gland Outer O-Ring	Nitrile	1
26D	2500	External Gland Outer O-Ring	Nitrile	1

Table 5-1: Recommended spare parts *(continued)*

Item No.	Daniel	Description	Material	Quantity
26D	2500	Internal Gland O-Ring	Nitrile	1
	150-2500	Slide Valve Lubricant		3 BOXES

Materials listed above are for standard "A" trim assemblies. For other trim options, consult with a Flow Lifecycle Services representative for Daniel products for materials of components which are different.

Important
See ordering information in When ordering parts, please specify (1).

5.2 Lubricant information

Product owners and operating personnel select the Daniel Senior Orifice Fitting for use in a wide variety of flow measurement services around the world. Information and experience gathered indicate that measurement service conditions do have a profound effect on the metal-to-metal slide valve sealing performance.

Each application presents its own unique set of service and environmental conditions. Therefore, Daniel offers four lubricant greases for use on the grease assisted, metal-to-metal Senior slide valve. These lubricants are:

Table 5-2: Daniel Senior Valve grease assisted metal-to-metal lubricants

Lubricant types	
Type 1-	Standard: Daniel part Number: 1- 213-04-001
Type 2 -	Sour Gas: Daniel part Number: 1- 213-04-102
Type 3 -	Carbon Dioxide: Daniel part Number: 1- 213-04-101
Type 4 -	High Temperature: Daniel part Number: 1- 213-04-103

The data contained in the following charts below are the result of sealing tests using a 3" ANSI 600 Senior Orifice Fitting. Daniel performed these tests under various laboratory conditions using nitrogen gas as the fluid. All sealing parts and grease were new. Test technicians also cleaned the grease delivery system prior to every test. Each chart represents one of the Daniel greases listed above.

Every filled grid indicates optimum seal performance at a corresponding temperature and pressure coordinate. The criteria for determining optimum sealing performance under test conditions was that, an electronic pressure transducer mounted on the Top (14) detected no leakage across the slide valve thirty (30) minutes after grease insertion. Every grid NOT filled indicates that some leakage occurred within the 30 minutes.

In order to perform a safe and efficient plate change operation, Daniel emphasizes that the on- site operator evaluate both the service and environmental conditions prior to selecting a lubricant. Additionally, Daniel realizes that some operators do allow leakage during a plate change operation for metal to metal valve seats based upon their

experience and the service conditions under which they are operating and have performed successful and safe plate changes.

WARNING

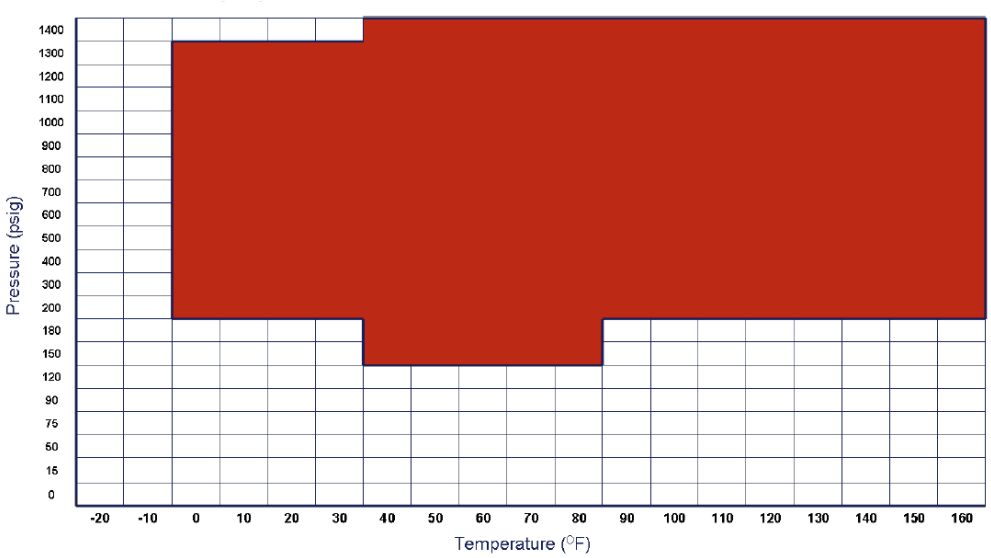
LEAKAGE OF TOXIC FLUID HAZARD

For Seniors with a soft-seated valve and grease-assisted slide valves, do not use the "QUICK CHANGE" procedure if the time to complete the plate removal and installation process will exceed 15 minutes.

Exceeding this time frame can allow leakage of possible toxic fluid from the seal. Failure to follow these instructions may result in death or serious injury.

One important factor for an owner or an operator to consider when selecting a grease for a particular application is plate change time. This is the period in minutes required for an operator to initiate, and complete, the Orifice Plate (13) change operation.

Refer to Plate change procedure overview.



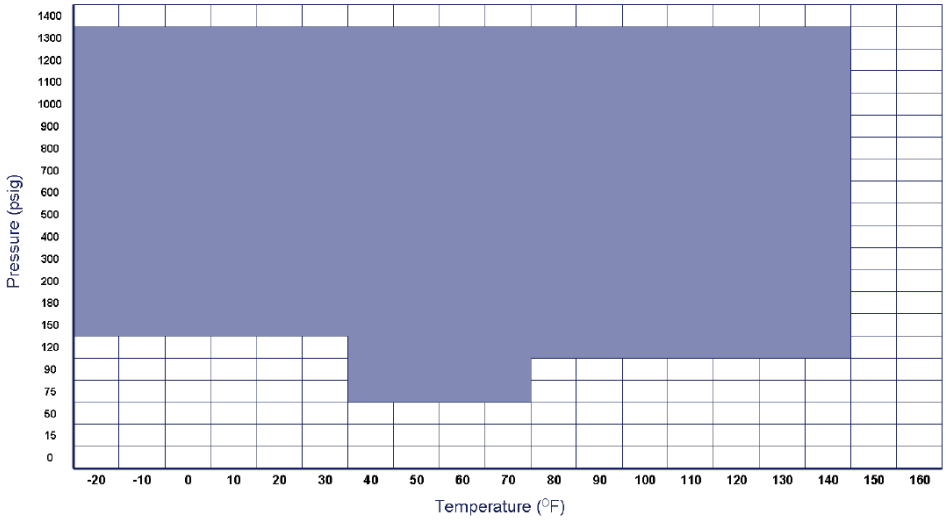
Pressure (psig) v. Temperature (°F) STANDARD GREASE - TYPE 1 - Part Number: 1-213-04-001 OPTIMUM SEALING RANGE WITH NITROGEN FOR A 3" ANSI 600 SENIOR FITTING UNDER LABORATORY CONDITIONS. Colored coordinate boxes indicate no detectable leakage at that Temperature and Pressure for 30 minutes.

This information can be used as a guideline when evaluating measurement applications. However, the pressure and temperature conditions to which a Senior may be exposed in an application may differ significantly from laboratory conditions.

Important

Customers should not rely solely on this information but rather must perform adequate testing on the particular application to confirm that the grease selected is appropriate for that application and will operate as intended.

Figure 5-2: Sour grease - Type 2

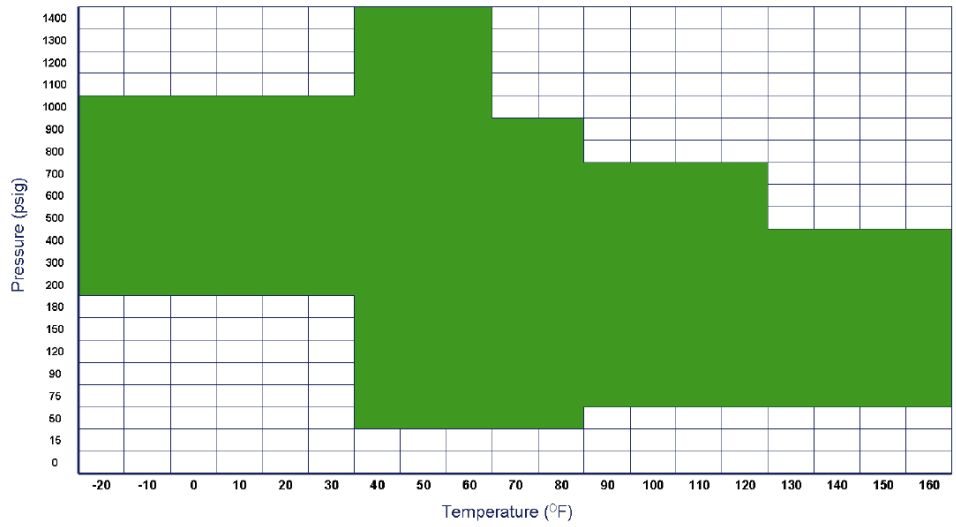


Pressure (psig) v. Temperature (°F) SOUR GAS GREASE - TYPE 2 - Part Number:1-213-04-102 OPTIMUM SEALING RANGE WITH NITROGEN FOR A 3" ANSI 600 SENIOR FITTING UNDER LABORATORY CONDITIONS. Colored coordinate boxes indicate no detectable leakage at that Temperature and Pressure for 30 minutes.

This information can be used as a guideline when evaluating measurement applications. However, the pressure and temperature conditions to which a Senior may be exposed in an application may differ significantly from laboratory conditions.

Important
Customers should not rely solely on this information but rather must perform adequate testing on the particular application to confirm that the grease selected is appropriate for that application and will operate as intended.

Figure 5-3: Carbon Dioxide grease - Type 3

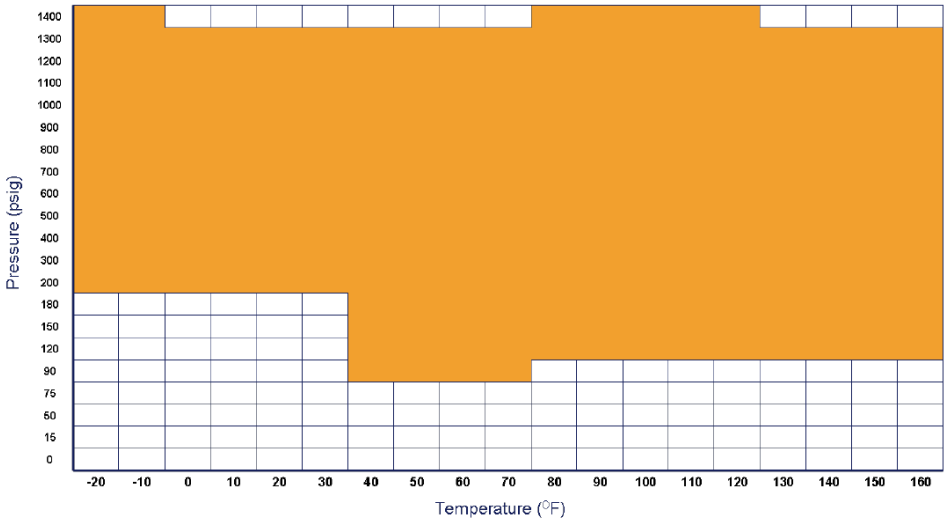


Pressure (psig) v. Temperature (°F) CARBON DIOXIDE GREASE - TYPE 3 - Part Number:1-213-04- 101 OPTIMUM SEALING RANGE WITH NITROGEN FOR A 3" ANSI 600 SENIOR FITTING UNDER LABORATORY CONDITIONS. Colored coordinate boxes indicate no detectable leakage at that Temperature and Pressure for 30 minutes.

This information can be used as a guideline when evaluating measurement applications. However, the pressure and temperature conditions to which a Senior may be exposed in an application may differ significantly from laboratory conditions.

Important
Customers should not rely solely on this information but rather must perform adequate testing on the particular application to confirm that the grease selected is appropriate for that application and will operate as intended.

Figure 5-4: High temperature grease - Type 4



Pressure (psig) v. Temperature (°F) HIGH TEMPERATURE GREASE - TYPE 4 - Part Number:1-213- 04-103 OPTIMUM SEALING RANGE WITH NITROGEN FOR A 3" ANSI 600 SENIOR FITTING UNDER LABORATORY CONDITIONS. Colored coordinate boxes indicate no detectable leakage at that Temperature and Pressure for 30 minutes.

This information can be used as a guideline when evaluating measurement applications. However, the pressure and temperature conditions to which a Senior may be exposed in an application may differ significantly from laboratory conditions.

Important
Customers should not rely solely on this information but rather must perform adequate testing on the particular application to confirm that the grease selected is appropriate for that application and will operate as intended.

5.3 Torque information

Daniel utilizes several joint assemblies to construct a fitting. For a fitting to pass all factory tests, assembly personnel apply a specific torque to each fastener used in the fitting to ensure proper operation and to seal the unit. See Table 5-3 in this section for suggested clamping bar screw torque values.

Product owners and product operators must realize that both time and service conditions impact the tightness and strength of joints originally assembled in the factory. Some, but not all, of these service conditions are:

- Time in service or storage
- Temperature cycles
- Vibration
- Mechanical loads

- Pressure loads
- Fastener thread condition (dirt/corrosion)
- Condition of joint assembly components (fasteners, gaskets, sealing surface conditions)
- Fastener lubrication and coatings

Daniel publishes these suggested torque values to help owners and users establish a starting point for applying torque to fasteners in service. The torque value applied to the clamping bar screws, necessary to achieve a seal, maybe greater or less than the suggested torque range in Torque information.

Again, these values are only a reference. They are reference values because it is impossible for Daniel to know all of the variable conditions (some listed above) that your fitting (under your care) will see in actual service. Only the owner or operator, after careful consideration of a fitting's service conditions, can specify a torque value to achieve an adequate seal. Therefore, owners and operators are ultimately responsible for joint assembly torque specifications. Again, owners and users are to use the torque values given in the following table as reference only.

Apply the torque values that you select using the sequencing patterns provided in this section and in accordance with industry or company bolting procedures.

Table 5-3: Clamping bar screw (11 size and suggested torque values

These values are **FOR REFERENCE** only.

Screw size	Suggested torque range (lbf·ft [N·m])		Maximum torque (lbf·ft [N·m])
	Lower	Upper	
1/2"-13	75 [101]	120 [163]	130 [176]
5/8"-11	120 [163]	195 [264]	265 [359]

These torques values are to help users establish a starting point to provide adequate assembly and in-service clamping force in most applications. These values are FOR REFERENCE only.

DO NOT apply torque greater than the Maximum Torque value.

These torque values reflect new, heat treated, alloy steel (AISI 4140) screws.

Owners and operators are ultimately responsible for all joint assemblies within their system, including the clamping bar screws of the Senior fitting.

Figure 5-5: Torque pattern sequences

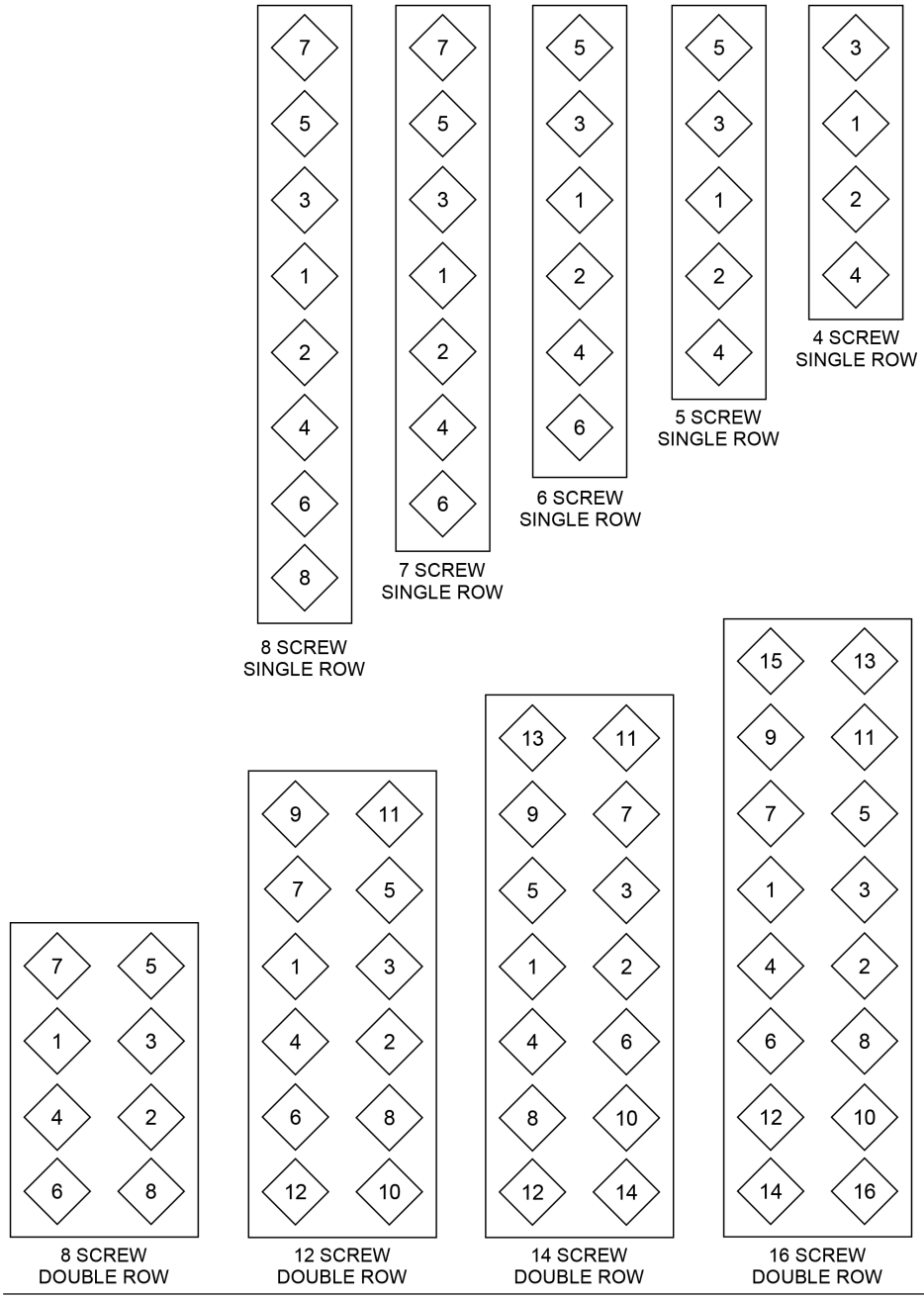
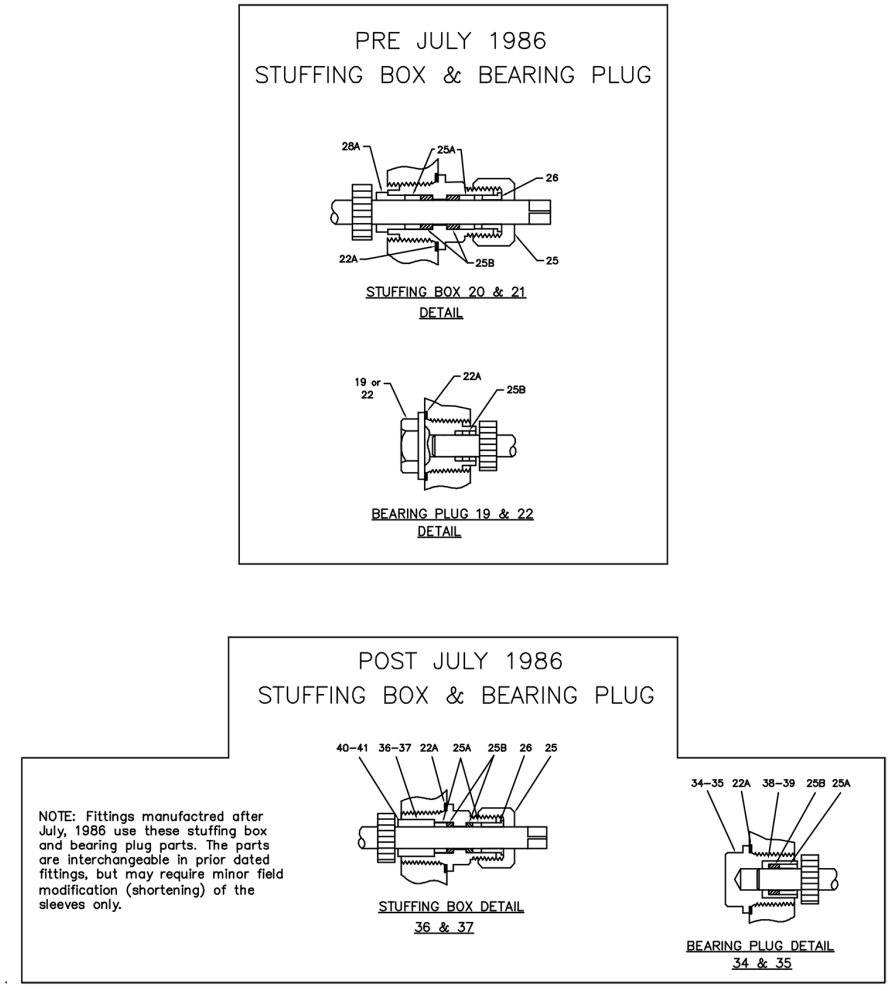


Figure 5-6: Stuffing box and bearing plug



5.4 Plate and Valve Carrier clearances

Table 5-4: Plate carrier to valve carrier clearances (inches)

Line size	Minimum clearance	Maximum clearance
18	.013	.039
20	.015	.044
24	.018	.053

With over 90 years of experience, Daniel is the only manufacturer that has the knowledge and experience to engineer and offer superior products that are trusted to provide the most reliable and accurate measurements in the global oil and gas industry.

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