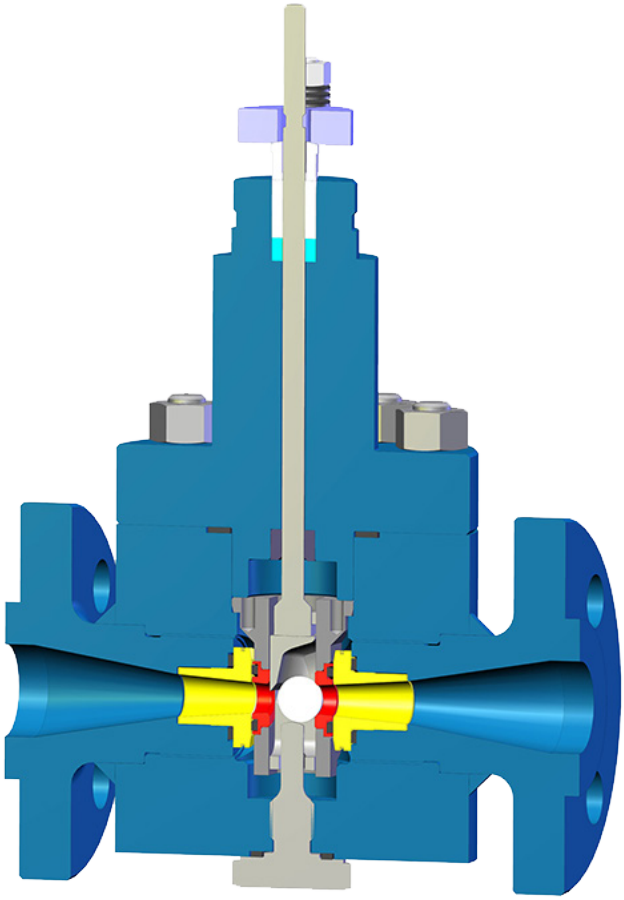
DFT® INC.

Maintenance & Instruction Manual

HI-100®

Severe Service Control Valve



DFT® HI-100® Control Valve
with Quick Change Trim
Top Entry Design

The Problem Solver™

Certified System
SAI GLOBAL
ISO 9001
Quality

DFT® INC.
140 Sheree Blvd.
P.O. Box 566
Exton, PA 19341-0566
e-mail: dft@dft-valves.com
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610-363-8903
800-206-4013
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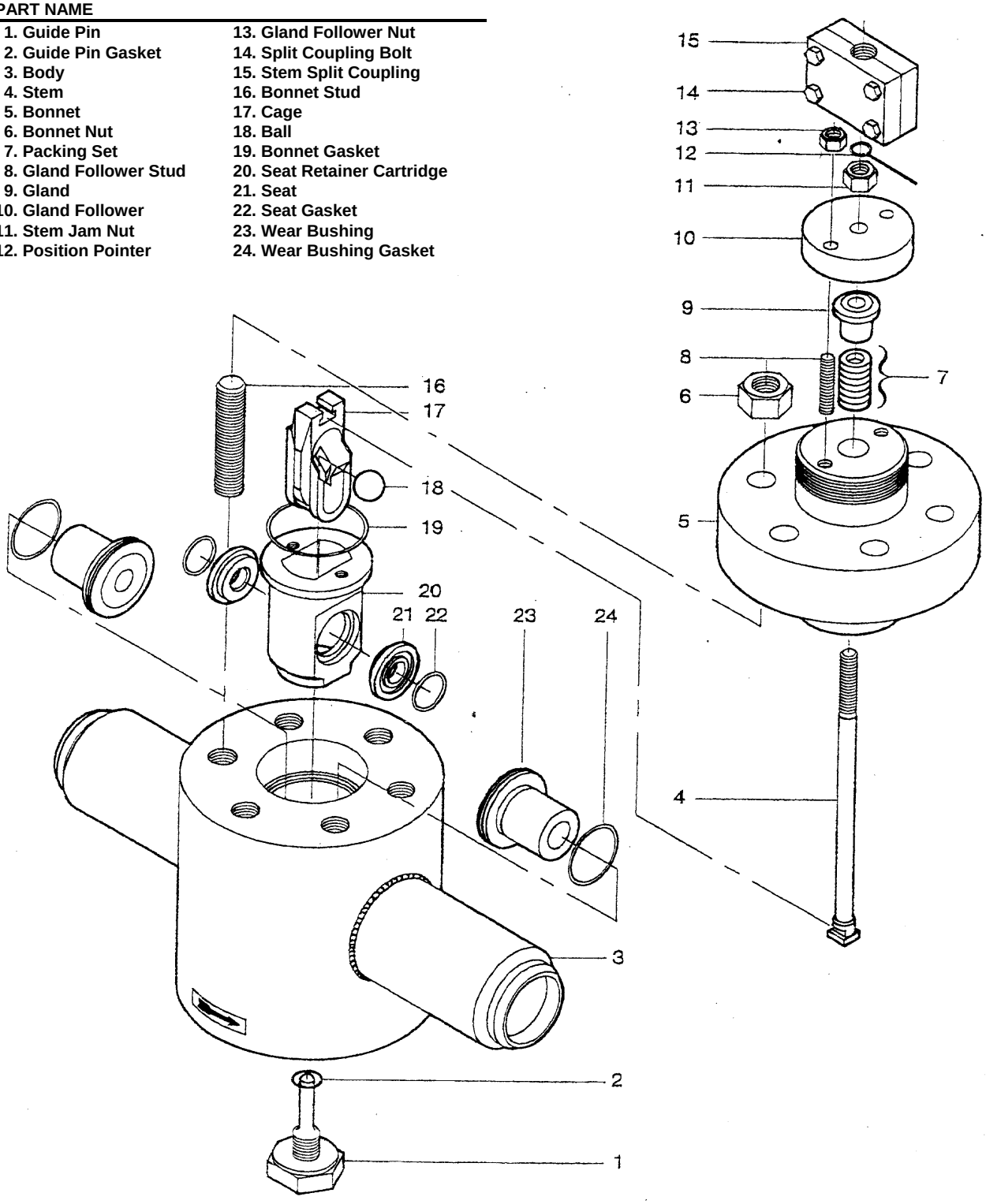
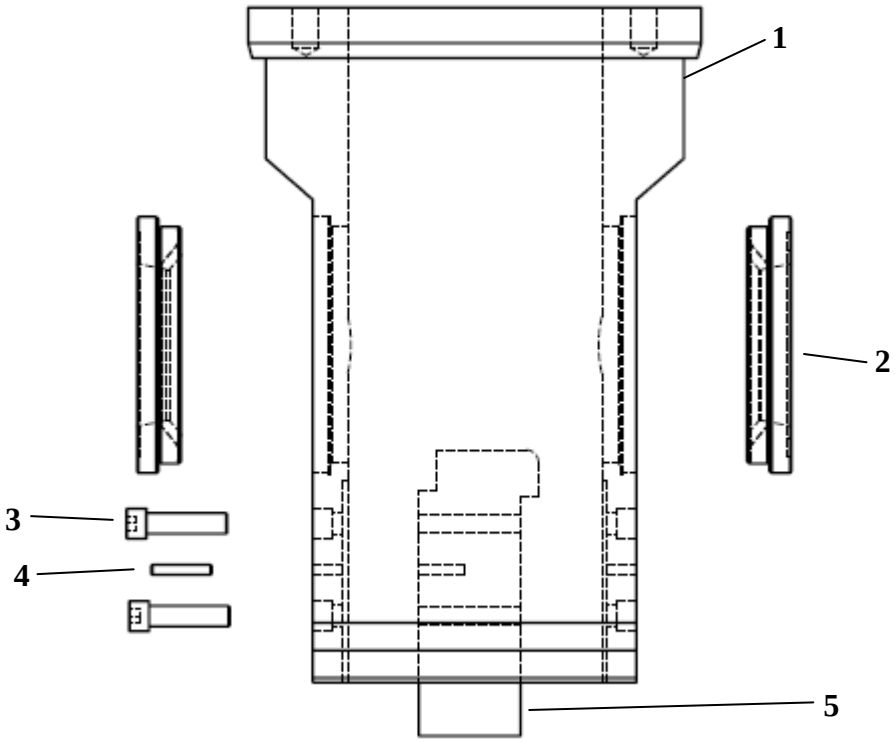
PART NAME

1. Guide Pin	13. Gland Follower Nut
2. Guide Pin Gasket	14. Split Coupling Bolt
3. Body	15. Stem Split Coupling
4. Stem	16. Bonnet Stud
5. Bonnet	17. Cage
6. Bonnet Nut	18. Ball
7. Packing Set	19. Bonnet Gasket
8. Gland Follower Stud	20. Seat Retainer Cartridge
9. Gland	21. Seat
10. Gland Follower	22. Seat Gasket
11. Stem Jam Nut	23. Wear Bushing
12. Position Pointer	24. Wear Bushing Gasket



For component part numbers, refer to the valve assembly drawing.

For Valves 2 1/2” Trim Size and Larger



Part Name – Cartridge Assembly	
1.Seat Retainer Cartridge	4. Dowel Pin
2. Seat	5. Guide Block
3. Capscrews	

Table of Contents

INTRODUCTION

This Manual has been prepared to serve as a guide for Installation and Maintenance of the DFT HI-100 Control Valve with Quick Change Trim.

Should the DFT HI-100 Control valve require maintenance, this manual should provide sufficient information to complete the necessary repairs. It is our intention for this manual to assist you in restoring the valve to good working condition in the most efficient manner.

It is very important to DFT the valve repair be successful and meet with your expectations. If any additional information should be required, please contact your local DFT Representative, or contact our company directly:

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SCOPE

Prior to starting the repair, it would be helpful to have some understanding of the DFT HI-100 Control valve's physical construction. Therefore, illustrations have been provided, and instructions will be found throughout this manual to clarify the construction of the valve.

Step-by-step instructions have been provided for disassembly of your valve configuration. Although there may be some minor differences from valve to valve, the basic instructions will provide sufficient general information to disassemble a given valve type.

In conclusion, we have also provided a list of all major components and recommendations for damage inspection and repair. Recommendations for spare parts, and torque requirements have also been provided with this Manual.

WARNING! USER SHOULD READ AND THOROUGHLY UNDERSTAND THESE INSTRUCTIONS BEFORE INSTALLING A DFT VALVE. THESE INSTRUCTIONS DO NOT PURPORT TO ADDRESS ALL OF THE SAFETY FACTORS ASSOCIATED WITH THE DFT VALVE'S USE IN SERVICE. IT IS THE RESPONSIBILITY OF THE USER TO ESTABLISH APPROPRIATE SAFETY, HEALTH, AND TRAINING MEASURES FOR THEIR PERSONNEL INSTALLING, SERVICING, OR WORKING IN AN AREA WHERE CONTROL VALVES ARE IN USE.

CUSTOMER AND/OR ITS INSTALLER SHALL BE RESPONSIBLE FOR THE PROPER INSTALLATION OF SELLER'S VALVE INTO A SYSTEM. CUSTOMER AND/OR ITS INSTALLER SHALL BE RESPONSIBLE FOR IMPROPER INSTALLATION AND PHYSICAL DAMAGE RESULTING THEREFROM, INCLUDING, BUT NOT LIMITED TO, DAMAGE RESULTING FROM LEAKAGE, IMPROPER TORQUING, AND FAILURE TO FOLLOW INSTALLATION INSTRUCTIONS.

RECEIVING

Upon receipt of the shipment, the shipping container should be thoroughly inspected for any signs of mishandling during transit. Obvious external damage to the shipping container should be noted on the carriers receiving paper; and if necessary, a claim should be filed with the carrier at that time.

UNPACKING

A. Once the shipping container is opened, the valve can be removed. Extreme care should be taken when removing the valve from the container. Although the valve itself is very rugged, actuators, positioners, air supply tubing, etc., are not, and therefore require care in handling to prevent possible damage. Set the valve aside in an area free from excessive exposure to dust, water and mud. Protective end connection caps or taped coverings should remain on the valve until the valve is ready for installation.

B. The valve serial number and part number are located on the valve nameplate. These unique identification numbers should be recorded, as it is most helpful when ordering spare parts. DFT maintains a file on each valve, and any special requirements are keyed to this unique valve serial number.

C. Prior to disposal of the shipping container, check the container for any loose pieces (i.e.: Spare Parts, Air Set, etc.) which may have been shipped along with the valve. Contents of the shipping container should be verified against the DFT packing slip.

INSPECTION

A. Prior to valve installation, the valve should be thoroughly inspected. Look for loose air fitting connections, loose fasteners, kinked air supply lines or other visual signs of obvious damage. These problems may be easier to correct prior to valve installation.

B. Remove the protective coverings from the valve end connections.

C. Using a suitable solvent, wipe the valve end connections to insure that they are free from corrosion, residual machining oils, and grease.

INSTALLATION

A. The installation area should be checked for adequate clearance to allow for proper servicing of the valve. Obstructions, overhead or below the valve, could hinder or prevent removal of the valve actuator or complete disassembly of the valve.

B. Locate the Flow Arrow on the Valve Body. Since the DFT Valve is a unidirectional product, the valve must be installed such that the directional Flow Arrow on the valve corresponds to the actual piping flow direction.

NOTE: Should the valve be accidentally installed with the flow in the wrong direction, the flow direction of the valve can be reversed without removing the valve from the pipe. To reverse the direction of flow, it will be necessary to follow the appropriate disassembly procedure, removing the Bonnet, Actuator, Cage, Ball and Stem, and rotating the Ball and Cage 180 degrees, so the

Ball will seat in the opposite seat. No need to remove actuator from bonnet in most cases.

WARNING: Contact DFT before rotating flow direction at 610-363-8903.

C. The transition of the valve end connection to the pipe should be as closely matched as possible. It is very important that the nominal bore of the pipe mates with the nominal bore of the valve end connection (i.e.: Schedule 160 to Schedule 160). The transition between the valve end connection and pipe end connection must be as smooth as is practical, and there should be no abrupt changes, which would introduce turbulence during service. When installing butt-weld end valves, be sure that back-up rings, when used, are of the consumable type.

D. When welding the DFT valve into the pipe, the valve should be in the open position. The inside of the throat of the Valve Body should be coated with a weld splatter guard.

E. Post weld heat treatment of Butt Weld End valves should be localized, and every precaution necessary should be taken to keep the intense heat away from the main portion of the valve.

NOTE: Valves with O-ring seals may require disassembly prior to localized stress relieving of the butt-weld area. Contact DFT if there is a question.

START-UP CHECKS

A. The valve stroke has been set at the factory and should not require adjustment prior to start-up. The actual stroke dimension was recorded at the factory before the valve was shipped. The stroke dimension should be noted, and recorded in your records for later reference.

B. It should not be necessary to disconnect or adjust the stem split coupling prior to start-up. If the Stem Coupling must be removed, please refer to Appendix C of this Manual for instructions for removal, installation, and adjustments.

C. If the valve has a Positioner, the calibration should be verified at this time. Although the Positioner was calibrated at our factory, it may require tuning to your system.

NOTE: Separate Instruction and Maintenance Manuals are provided for the specific Actuator and Positioner type shipped on each valve. These Manuals will be sent as part of the DFT Final Documentation Package.

D. Actuator adjustments have been made at the factory and should not require further adjustment.

E. All DFT Control Valves have fixed mechanical stops that limit the Valve Stroke and protect the internal components from damage as a result of over-stroking. The

mechanical stops are internal to the valve and/or actuator and should not be altered without first consulting our factory.

If there are any problems or questions during Start-Up, contact your local DFT Valve Representative immediately, or contact DFT at 610-363-8903.

TROUBLESHOOTING

Many external elements can affect a valve's overall performance. Frequently, the valve is thought to be malfunctioning when actually it is some other component that is at fault.

When a valve is malfunctioning, all possible external causes should be investigated before disassembling the valve. Some typical external source problems are:

A) No Power
B) Inadequate power supply to the Valve Actuator
C) Loose pneumatic fittings at the Actuator, Positioner or Air Set.
D) Ruptured Diaphragm in the Pneumatic Actuator
E) Broken Spring in mechanical failure mode Actuator
F) Improperly calibrated Positioner
G) Improper signal from the Controller to the Valve Positioner
H) Improper Valve Stroke adjustment
I) Over-tightened Stem Packing
J) Loose mechanical linkage to the Positioner Drive Arm
K) Loose Stem Split Coupling between the Actuator Shaft and the Valve Stem
L) Misalignment between the Actuator Shaft and the Valve Stem

These are just some of the many external problems which can have an effect on a valves performance. If the problem persists after eliminating all possible external causes, it may be necessary to disassemble the valve.

IMPROPER VALVE OPERATION SHOULD ALWAYS BE CALLED TO THE ATTENTION OF YOUR LOCAL DFT VALVE REPRESENTATIVE, OR CONTACT DFT DIRECTLY at 610-363-8903.

RECOMMENDED SPARE PARTS

The materials of construction used in the DFT HI-100 Control Valve have been selected to be compatible with the intended service, and to provide the longest possible service life. However, DFT suggests that some components be carried in your stockroom as spare parts for unexpected emergencies. Delivery lead times for items such as Seats, Wear Bushings, Cages, and Stems may run as long as 4 to 6 weeks. The following table shows the recommended spare parts. Item numbers correspond to those shown on page 2 of this manual.

Recommended Spare Parts (Quantities shown are for one valve)					
Item	Description	For Commissioning	Minor Repair Kit	Major Repair Kit	Complete Repair Kit
1	Guide Pin				1
2	Guide Pin Gasket	1	1	1	1
3	Body				
4	Stem				1
5	Bonnet	Normally not required as a spare part			
6	Bonnet Nut				
7	Packing Set		1	1	1
8	Gland Follower Stud	Normally not required as a spare part			
9	Gland				
10	Gland Follower				
11	Stem Jam Nut				
12	Position Pointer				
13	Gland Follower Nut				
14	Split Coupling Bolt				
15	Stem Split Coupling				
16	Bonnet Stud				
17	Cage				1
18	Ball		1	1	1
19	Bonnet Gasket	1	1	1	1
20	Cartridge	Included in the Cartridge Assembly (2 seats)			
21	Seat				
21A	Cartridge Assembly			1	1
22	Seat Gasket		2	2	2
23	Wear Bushing			1	1
24	Wear Bushing Gasket		2	2	2
	Cartridge Tool		1	1	1
	Lapping Tool		1	1	1

- Spare parts **For Commissioning** are only required when the bonnet is removed for weld
- The **Minor Repair Kit** contains all items normally used during the initial valve service.
- The **Major Repair Kit** contains all items normally used during the second valve service.
- The **Complete Repair Kit** contains all items normally replaced during the valve life.

DFT recommends that the end user orders a Minor Repair Kit with each valve. Only one tool set is required per valve size.

When ordering Spare Parts, please refer to the valve serial number stamped on the valve nameplate. This number also appears in the final documentation package sent to you by DFT.

In this documentation package, DFT will include a copy of the engineering Bill-of-Materials that provides part numbers for each of the individual components. When ordering spare parts, please include the component part number and the serial number of the corresponding valve. This will help ensure that the correct parts are supplied. Spare Parts can be ordered by contacting your local DFT Representative, or by contacting:

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Web site: www.dft-valves.com

DISASSEMBLY

In the step-by-step instructions that follow, we have attempted to address disassembly in a thoroughly detailed manner. If at any time you should encounter difficulty, please notify your local DFT Valve Representative, or contact DFT at 610-363-8903.

Before the valve is disassembled, DFT recommends that the following points be reviewed:

1. Inspect the work area to see if hoist devices, safety barriers, scaffolding, etc., be required to complete the work. If so, this should be completed before disassembly begins. Make note of the various size and type tools that will be required and gather these together before work begins.
2. Review the valve assembly drawing to become more familiar with the valve and how the various components fit together.

   NOTE: The valve assembly drawing is supplied as part of the Final Documentation Package when the valve order is shipped.

3. Check to be sure that all of the proper spare parts are on hand and are in good service condition.
4. Valves that are mounted in a vertical pipe (with flow down) and those valves that are mounted in an inverted position (with the valve stem down) will require special attention when removing the Ball and Cage. A piece of shim stock, of appropriate thickness and width, inserted into the valve between the Cage and downstream Seat, will allow the Ball to pass over the Seat for removal.

WARNING: MAKE SURE ALL THE PRESSURE IS RELIEVED, BOTH UPSTREAM AND DOWNSTREAM, BEFORE DISASSEMBLY WORK IS STARTED. FAILURE TO DO SO COULD RESULT IN PERSONAL INJURY. BEFORE ATTEMPTING TO SERVICE THIS VALVE, A POSITIVE METHOD OF VERIFYING THAT ALL LINE PRESSURE HAS BEEN RELIEVED SHOULD BE DEMONSTRATED.

5. In most cases, the actuator will need to be uncoupled from the valve in order to facilitate maintenance. Refer to Appendix C for a detailed look at the split coupler connection. Loosen the Jam Nut on the bottom of the Split Coupler. Note that this is a left-hand thread.

NOTE: If your valve's stem has an acme thread, run the actuator off of the stem with either the handwheel or electric controls.

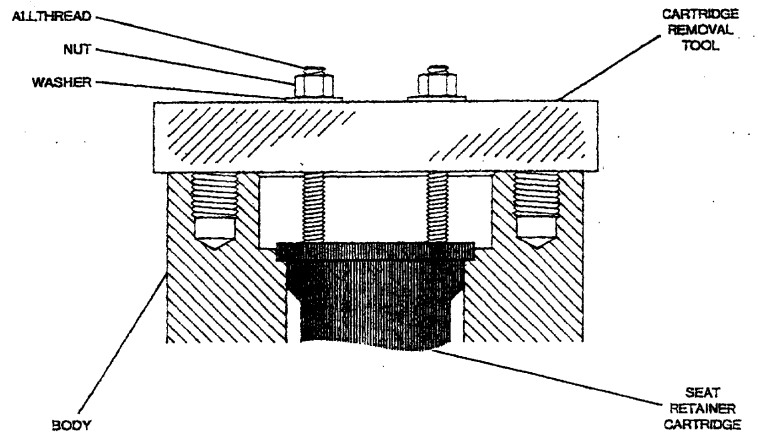
6. Using the actuator, stroke the valve to the fully closed position.
7. Remove the four hex head screws that hold the Split Coupler together. With the flat blade of a screwdriver, pry the two halves of the Split Coupler apart and remove them from the valve and actuator stems.
8. Remove any positioner feedback linkages, position indicators, jam nuts, etc from the valve stem. Release the supply to the actuator and allow it to return to its failure position. Disconnect actuator supply, input signals, and all external connections (limit switches, solenoids, etc.).
9. Depending on the weight of the actuator and its mounting yoke, it may be desirable to remove the actuator from the valve. Do so at this time.
10. Loosen the valve stem Packing by removing the Follower Nuts from the Follower Studs.
11. Mark the Body and Bonnet with adjacent marks so that their relative positions can be duplicated when the valve is reassembled.
12. Loosen and remove the Bonnet Nuts from the Bonnet. Using an overhead lift mechanism, lift the Bonnet straight up off of the Valve Body. Take care in lifting the Valve Bonnet straight up so that no side load is put on the Valve Stem.

NOTE: The Valve Stem, Cage and Ball will likely be removed from the valve along with the Bonnet. Although the Bonnet slips out of the Body, it may be necessary to pry the Bonnet free.

13. Set the Valve Bonnet off to the side. Remove the Ball from the Cage. Slide the Cage off of the Valve Stem. Pull the Valve Stem out of the Bonnet. Remove the Packing from the Bonnet.
14. If the Bonnet, Stem, Cage and Ball were not removed with the Bonnet, they should now be removed from the Valve Body. The Bonnet Gasket/O-Ring should also be removed from the valve body at this time. It may make further disassembly easier if the Bonnet Studs are also removed.

NOTE: Disassembly to this point will allow visual inspection of the valve trim components. If replacement of the valve seat or other component is needed, continue to the end of this section.

15. Screw two pieces of allthread into the tapped holes in the top of the Seat Cartridge. Refer to Appendix D to determine the size and length of the allthread required.
16. Install the Cartridge Removal Tool (See Appendix D) over the top of the two pieces of allthread. Thread a hex nut onto the end of each piece of allthread and snug it down against the Cartridge Removal Tool. As the nuts are tightened down against the Tool, the Cartridge is slowly jacked out of the body. Alternate between the two nuts to keep the Cartridge even. Continue tightening the nuts until the Cartridge is free. Remove the Cartridge Removal Tool and pull the Cartridge out of the Body.



17. Remove the Guide Pin by screwing it out from the bottom of the Valve Body. Remove the Guide Pin seal that is located under the head of the Guide Pin. If your valve has a trim size of 2.5" or larger the guide block can be taken out by removing the capscrews and dowel pin from the seat retainer cartridge (See pg 3).
18. Using the flat blade of a screwdriver, or pry bar, pry the Wear Bushings out of the valve and remove them from the Body. A groove has been machined in the outer flange of the Wear Bushing for this purpose. Slightly rotating the Wear Bushing, with a back and forth motion while pulling out of the body pocket, will prevent the Bushing from becoming cocked. The Wear Bushing Gaskets/O-Rings should also be removed.

PARTS INSPECTION AND REPAIR

Ball

(A) Examine the Ball for any evidence of damage. The Ball should be free of any visible defects. Note that it is not uncommon to see tracking marks (discoloration, but no physical damage) on the Ball resulting from contact with the cage, but this is normal and of no concern.

(B) Minor scratches and small cuts may be repairable by lapping. More severe cuts may be possible to repair by welding and lapping.

(C) All Stellite and ULTRA-loy Balls should be examined by the Liquid Penetrant method for detecting cracks. Cracks or porosity justify replacement.

NOTE: The condition of the Balls surface is very critical for maintaining a tight shut-off. If even the smallest of defects were detected, it would be better to contact the DFT Engineering Department for clarification than to put a defective Ball back into service.

Seat

(A) Examine the upstream and downstream seating surface for slight scratches, wiredraw, cavitation and flashing damage. Small indications of damage on the Seat face may be removed by lapping with a Seat Lapping Disc. Refer to Appendix A of this manual for instructions concerning lapping.

(B) Examine the Seat surface for evidence of a burnished ring from contact with the Ball. This ring should be continuous. Apply a very light film of Layout Bluing to the Ball and slightly rotate the Ball in the Seat. After the Ball is removed there should be a continuous ring in the Seat just slightly above the Seat bore. If the ring is not continuous, seat lapping will be required. Refer to Appendix A for proper instructions.

(C) The Downstream Seat may have a heavy burnish (dimple) at the 12 o'clock position. This is normal and should not be of concern as long as it does not extend into the sealing ring area of the seat face.

(D) All Stellite Seats should be examined by the Liquid Penetrant methods for cracks. Cracks or porosity justify replacement.

(E) Examine the Gasket / O-Ring pocket for any evidence of damage.

Generally, lapping can repair minor seat damage. However, severe damage will almost always require replacement.

Cage

(A) Examine the T-slot corners for evidence of cracking. Also, check the T-slot ears for excessive wear. Solid investment cast Stellite (Alternative cage material is a 400 series stainless) Cages (Sizes 1/4" to 2"), should be inspected by the Liquid Penetrant method for cracks in the area of the T-slot.

(B) Examination of the four Ball Pads should reveal some evidence of wear (burnished dimples). This condition is normal and generally will not require any corrective action. Contact the DFT Engineering Department regarding any defects of a questionable nature at 610-363-8903.

NOTE: Extreme care should be taken when fitting the Cage to the Stem head. A sliding fit between the Stem head and Cage T-slot is required for the assembly to function properly. However, when pulling on the Stem it should not be loose at the Cage T-slot. If it is necessary to shorten the head of the Valve Stem, it should be done with a flat file or an air grinder while the stem is rotated in a lathe or by other means. The spherical radius on the end of the Stem must be maintained.

Stem

(A) Examine the Stem threads for possible damage and clean thoroughly.

(B) Examine the area of the Stem that travels through the packing for possible scratches and/or galling. Small scratches (less than .003" deep) can be removed by polishing with emery cloth and a lightweight machine oil. This should only be attempted on a lathe, and should be blended into the surrounding surface.

(C) Examine the Stem T-head for evidence of heavy wear or cracks.

(D) Examine the Stem on a flat surface to determine if it has been bent.

(E) Stems that are severely scratched, bent or have damage to the T-head should be replaced.

Wear Bushing

(A) Examine the inside diameter (throat) of the Wear Bushing for evidence of cavitation, flashing, or erosion damage. Damage of this type will generally be evident in the downstream Wear Bushing only.

(B) Examine the Gasket/O-Ring contact surface on the back face of the flange portion of the Wear Bushing to insure it is free of defects.

(C) Examine the front face of the Wear Bushing where the Seat Gasket/O-Ring seals. This area should be free of damage and minor scratches. Minor scratches, not more than .003", may be removed using emery cloth and a lightweight machine oil. Work the scratches out in a circular motion on a true flat surface.

In an emergency, most damaged Wear Bushings are still serviceable by rotating the damaged area 180° from how it was originally installed in the endpiece. However, a damaged Wear Bushing should not remain in service for a prolonged period of time, as this could lead to Valve Body damage.

Guide Pin

(A) The Guide Pin should be checked to determine if it is bent. Bent Guide Pins should be replaced.

(B) A slight burnish or dimple may be detectable on the very tip of the Guide Pin. This is normal and generally will not require repair.

(C) The Guide Pin may be retained by one of a number of methods: screwed, shrink fit and attached to the Seat Cartridge. Regardless of the method of retention, the Guide Pin should be closely examined to verify that the Guide Pin is secure.

(D) The clearance between the top of the Guide Pin and the Ball is critical. The method of checking and adjusting this dimension is addressed in Appendix B of this manual.

(E) Severe damage to the Guide Pin is usually a result of valve over-stroke. Carefully setting the valve stroke in accordance with the instructions set forth in Appendix C of this Maintenance Manual will eliminate the chances of damaged or broken Guide Pins.

(F) The guide pin gasket should be replaced with a new gasket once removed.

Seat Cartridge

(A) Examine the Seat Pockets for any evidence of damage. Before installing new Seats, the Seat Pockets must be clean and free from defects. Make sure all burrs and raised surfaces are removed. Refer to Appendix A of this Maintenance Manual for instructions pertaining to the Removal and Installation of new Seats in the Seat Cartridge.

(B) Examine the outside diameter on the small end of the Seat Cartridge. This is the locating surface that mates with the inside of the Valve Body. The diameter must be clean and free of any major defects (i.e. - galling, gouges, etc.) which would prevent the Cartridge from properly locating in the Valve Body.

Looking inside the Cartridge, a slight impression at the 12 o'clock position, just above the Seat Ring on the downstream side, may be detectable. This is normal wear and should not be of concern unless the impression is more than about .015" deep.

Bonnet

(A) Examine the Stem Backseat area for excessive wear and/or galling. Damage in this area should be repaired before putting the valve back into service. Small defects can be repaired by honing the I.D., and by taking a very light machine cut (.005" to .010") on the Backseat face. Severe damage will require replacement or extensive rework. Contact the DFT Engineering Department with questions regarding major repairs in this area.

(B) Examine the Gasket / O-Ring Face for scratches or evidence of other types of damage. Small defects may be removed by polishing with emery cloth and a lightweight machine oil, while turning the Bonnet in a lathe. Larger defects may require machining; however, tolerances on this component are critical, and machining should not be done without first contacting DFT .

(C) Examine the Packing Chamber. The chamber should be thoroughly cleaned prior to repacking. If necessary, the Packing Chamber I.D. can be lightly honed.

Typically, the Bonnet will not require extensive repair during the service life of the valve. The most critical areas are the Gasket Surface and the Packing Chamber. These areas must be clean and free of scratches and defects.

Body

(A) Examine the inside of the Valve Body to look for signs of wear or damage. If damage is detectable, it may be necessary to repair the Body.

(B) Examine the pockets of the endpieces where the Wear Bushing Gaskets/O-Rings are located. These areas should be free of scratches and erosion.

(C) Examine the Bonnet Gasket/O-Ring sealing pocket for defects. This area should be clean and free of all obvious defects. Small scratches, nicks or scrapes can be removed by lightly polishing with emery cloth and lightweight machine oil.

The Body is the primary pressure vessel; therefore, the condition of this component is very critical. No defect, of any type, should go unquestioned. If an area has questionable defects contact the DFT Engineering Department at 610-363-8903.

Bonnet Seal

Regardless of the type of seal used (i.e.: Metal Spiral Wound, O-Ring, Pressure Seal Ring), it should always be replaced with a new seal prior to reassembly.

Seat and Wear Bushing Seals

Regardless of the types of seals used (i.e.: Metal Spiral Wound, Elastomeric O-Ring), they should always be replaced with new parts prior to reassembly.

NOTE: The metal spiral wound seat and wear bushing gaskets used in the DFT HI-100 valves are special pre-stressed gaskets. Standard spiral wound gaskets must not be used, as they may make re-assembly of the valve more difficult.

Stem Packing

NOTE: In order to prevent external emissions of process fluid, it is recommended that all Valve Stem Packing be replaced upon valve re-assembly.

When installing new Packing, make certain the Stem and Bonnet Packing Chamber are thoroughly cleaned to insure the best possible seal. Install each new Packing Ring separately, pushing each Ring to the bottom of the chamber. If Split Packing Rings are being used, make certain the cuts of each consecutive Ring are staggered.

REASSEMBLY

In most cases, reassembly is the reverse of disassembly. If at any time during reassembly you should encounter difficulty, please notify your local DFT Representative, or contact DFT at 610-363-8903. We will respond immediately to your questions.

1. The most important consideration in the reassembly of the DFT HI-100 Control Valve is cleanliness. All flaky rust and dirt should be removed with a suitable solvent. All sealing and seating surfaces should be thoroughly inspected and cleaned.

2. While cleaning the parts, take time to examine them for nicks, dings, or burrs, which could possibly create problems during reassembly. Refer to the previous section Part Inspection and Repair for recommendations as to what to look for, and how to correct the defect.

3. All threaded parts should be thoroughly cleaned with a suitable solvent and a wire brush. All threaded parts should then be re-lubricated with a high temperature product such as LOCTITE Nickel Anti-Seize or NEVER-SEEZ.

   CAUTION: When applying anti-seize during reassembly, exercise care so that the anti-seize does not come in contact with the gaskets, or gasket seating surfaces.

4. Take time to look into the Valve Body for any loose debris (i.e.: weld rods, boards, rags, etc.) which may have fallen into the valve. Foreign objects in the pipe can render a perfectly rebuilt valve useless, as well as cause irreparable damage to the valve.

5. Dry fit the Wear Bushings into the Body Pockets. The Wear Bushings should slip freely into the Pockets, and should turn freely when slightly rotated.

6. Apply a proper seal lubricant (i.e.: White Lithium Grease for Spiral Wound Metal Gaskets, Silicone Base O-Ring lubricant for O-Rings) to the sealing surface of the Wear Bushings. This will help hold the Gasket or O-Ring in place when the Wear Bushings are installed into the Valve Body. Place the Wear Bushing O-Ring or Gasket on the Wear Bushing. Also, apply a high temperature anti-seize lubricant to the outside diameter of the Wear Bushing.

7. With the Gasket / O-Ring in place, insert each Wear Bushing into the Body Pocket, and rotate it slightly to insure it is not cocked.

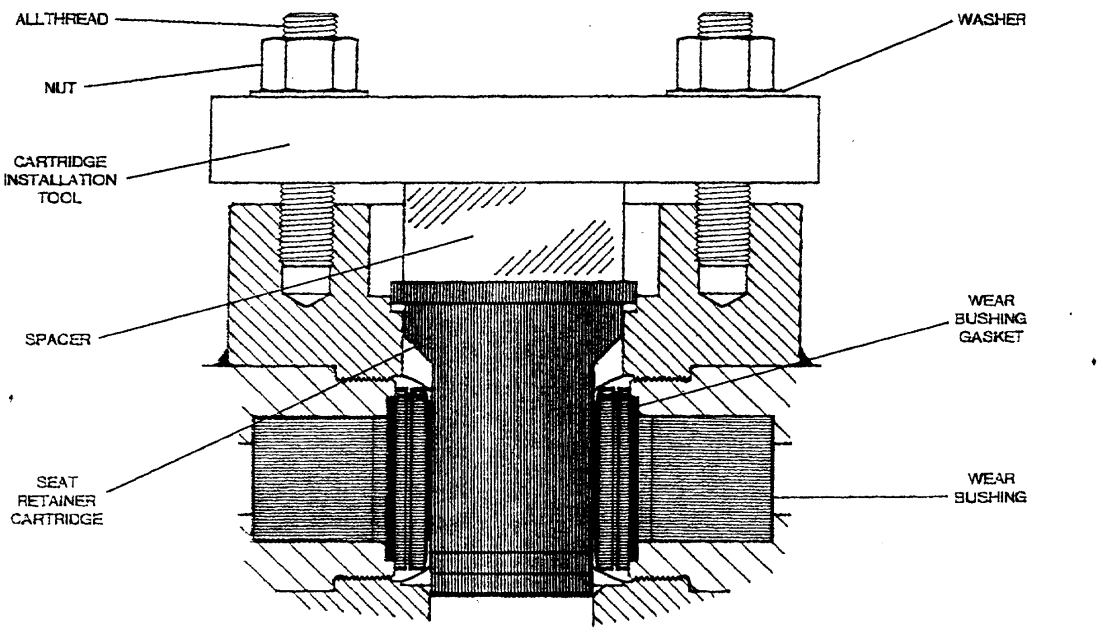
8. Install a new Guide Pin Gasket / O-Ring, and then screw the Guide Pin into the Valve Body from the bottom. Make sure that the Guide Pin Threads are lubricated with anti-seize compound. If this is a new Guide Pin, refer to Appendix B for Guide Pin adjustments before installing the Pin.

9. Apply a liberal coating of a suitable lubricant to each of the Wear Bushing faces after they have been seated into the Valve Body Pockets. Use white lithium grease for metal spiral wound gaskets, or silicone grease for O-Rings.

10. Prepare the Seat Cartridge, with Seats installed, for installation. Apply a small amount of a suitable lubricant to each of the Gasket / O-Ring Pockets in the Seats. This will help retain the Gaskets / O-Rings while the Cartridge is installed into the Valve Body. Install the proper Seals in the pockets of the Seats. Now apply a liberal coating of lubricant to the face of each Seat. Also, apply a thin coating of a high temperature anti-seize to the large outside diameter guide surface (large end), and the small outside diameter guide surface (small end), of the Seat Cartridge.

11. Place the Seat Cartridge into the Valve Body. Valves that have O-Ring seals should not require the use of the Seat Cartridge Installation Tool. Slowly pushing the Cartridge into the Valve Body by hand should create sufficient force to properly seat the Cartridge. Valves that have gasket seals require more force on the Cartridge. It may be necessary to use the Seat Cartridge Tool as described in Appendix D.

12. Place a spacer block on top of the Cartridge. Place the Cartridge Tool on top of the spacer block while capturing two of the body studs. Thread hex nuts onto the studs and down against the Cartridge Tool. Taking alternating turns on the nuts of the Seat Cartridge Tool, begin to push the Cartridge into the Valve Body. Stop from time to time to measure the distance from the top of the Seat Cartridge to the top of the Body to insure that the Cartridge is going into the Valve Body squarely.



13. Remove the Cartridge Installation Tool and insert a clean rag into the port of each Seat to remove any excess lubricant that may be present. Examine the rag for any signs of shavings (metal shavings from Spiral Wound Gaskets, or rubber shavings from O-Ring Gaskets). Evidence of shavings may indicate that one of the seals has sheared; in which case the Cartridge should be removed and inspected for cause. Reassemble once corrective action has been taken.

NOTE: The filler material used in Metal Spiral Wound Gaskets will commonly shear during installation; however, this is normal and is not cause for concern or rejection. If uncertain about the acceptability of sheared material, or the fit-up of the gaskets, please contact DFT at 610-363-8903. CAUTION: Metal shavings from a sheared Spiral Wound Gasket are very sharp and could result in cuts to the hands and/or fingers. Exercise extreme caution when wiping the Seat Port Areas.

14. Check the alignment of the Seat bore with the bore of the Wear Bushing. The transition all around the inside diameter of the Seat Ring must be smooth. If a step is detected, it means that the Cartridge is not fully bottomed out in the valve body. After determining that the Seat Cartridge is square in the Body, install the Cartridge Installation Tool and push the Cartridge into the Valve Body until it properly bottoms out in the Body.

15. Slide the end of the Valve Stem into the T-slot of the cage. Check the fit between the Cage and the Valve Stem; this fit is very critical. If either the Valve Stem or the Cage was replaced, it may be necessary to fit the Valve Stem to the Cage. There should be a sliding fit between the knob end of the Stem and T-slot of the Cage. The Valve Stem should be free to slide within the Cage, but excess play should be avoided. If it is necessary to shorten the head of the Valve Stem, it should be done with a flat file or an air grinder while the Stem is rotated in a lathe. The spherical radius on the end must be maintained.

16. Carefully place the Ball into the Cage. Lower the Stem, Cage and Ball assembly into the Valve Body.

    CAUTION: It is very important that the ball and cage be properly oriented. The open side of the cage must face downstream such that the ball can freely move into the downstream seat.

    NOTE: Valves mounted in a vertical pipe, with flow down, will require special care when installing the Stem, Cage and Ball assembly. It is suggested that a piece of shim stock, of suitable thickness, be placed into the valve on the Downstream Seat. This will hold the Ball in place until it passes over the Seat, at which time the shim material should be removed.

17. Apply a liberal coating of lubrication to the new Bonnet Seal and place it in its groove in the top of the Valve Body.

18. Apply a thin coat of high temperature anti-seize to the small diameter (the end that goes into the Body) of the Bonnet. Lift the Bonnet over the Valve and carefully lower it into place as the Valve Stem slides through the Bonnet. Take care not to scar the Valve Stem as the Bonnet is lowered into place.

19. Make sure that the Bonnet is fully seated against the Valve Body. Move the Valve Stem up and down a few times to ensure that it moves freely and is not bound. Thread the Bonnet Nuts onto the Studs and torque them down. Refer to Appendix E for recommended torque values.

20. Install new Packing onto the Valve Stem. Install the rings one at a time to ensure that they are properly seated in the packing chamber. If the packing contains split rings, ensure that the cuts in consecutive packing rings are staggered around.

21. Slide the Packing Gland and Follower onto the Valve Stem. Screw the Follower Nuts onto the Studs to hold the Packing, Gland, and Follower in place, but do not torque down the Nuts at this time. Using your hand, manually push down on the valve stem to ensure that the valve is in the fully closed position and that the Ball is firmly positioned in the seat.

22. Install the Actuator.

23. Screw the Jam Nut fully onto the Valve Stem. Remember that this is a left-handed thread. Place the position indicator and any feedback brackets onto the stem.

24. Referring to Appendix C, install the Stem Split Coupling and adjust the Valve Stroke.

25. Torque down the valve stem Packing. The torque value is dependent on both the size of the packing and the operating pressure of the valve. Refer to the Production Check Sheet that is found in the documentation package supplied by DFT when the valve was originally shipped.

26. Cycle the actuator 10 times opened and closed to consolidate the packing. For graphite style packing re-torque and clean any residue off the stem during the first 10 cycles.

27. Restore all external sources (i.e. Power Supply, Signal Supply, etc.) and actuate the valve through several cycles. The valve should operate smoothly, and should freely stroke from the fully closed position to the fully open position.

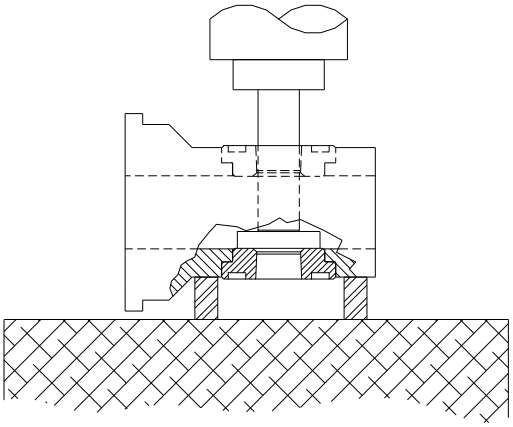
Appendix A

REMOVAL AND INSTALLATION OF NEW SEATS

- **DFT strongly recommends that seat installation is performed at the DFT Factory or by an authorized service center. The end user should have a cartridge assembly as a spare part. This is part of the "Major Repair Kit". By doing so, in-line valve repair is a fast and easy process.**
- **For Trim sizes 2.5" and larger: Remove guide block from cartridge before proceeding with seat removal instructions (see page 3).**

Seat Removal:

1. The seats are held in the cartridge by a light interference fit. It may be necessary to use a press to remove the seats from the cartridge. Typically, only a small press load will be required; therefore, this can be done on a manual rack and pinion type press just as easily as on a hydraulic press.
2. Place the Seat Cartridge on its side, one seat facing down and the other seat facing up, with a piece of pipe, tubing or other shims between the bed of the press and the Seat Cartridge. The seat to be removed should be facing down. Check the height and spacing of the shims to ensure that the Seat rings will drop free from the Cartridge.



3. Place a flat metal disk, slightly smaller in diameter than the Seat itself, on top of the down side Seat inside the Seat Cartridge.
4. Insert a metal rod through the hole in upside Seat and allow it to rest on the metal disk.
5. Lower the press ram until it comes in contact with the metal rod, making sure that the metal rod is vertically square with the press bed.
6. Begin increasing press load until the Seat drops free of the Seat Cartridge.
7. Turn the Seat Cartridge over and repeat the above steps for the remaining Seat.

New Seat Installation:

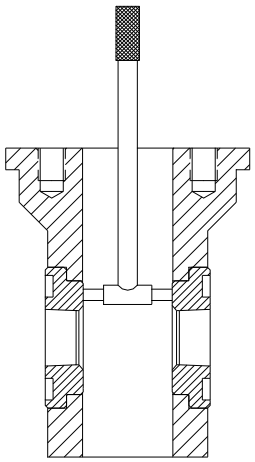
CAUTION: Do not attempt to press the seats into the seat cartridge, attempting to press the seat into the seat cartridge can cause severe damage to the cartridge.

1. Inspect the seat pockets, in the Seat Cartridge for signs of damage. The pockets should be free of burrs and dings. With a suitable solvent, thoroughly clean the seat pockets, removing all traces of grease, dirt, scale metal chips, etc.
2. Inspect the new Seat Rings. They should be thoroughly cleaned and free of any burrs.

3. Attempt to fit the Seat Rings into the Seat Cartridge. The Seat rings should not fit into the Pockets.
4. Place the Seat Rings in liquid nitrogen long enough for the boiling action to stop (approximately 15 minutes). If liquid nitrogen is not available, place the rings on dry ice for a minimum of 45 minutes.

   WARNING: SEVERE FREEZE BURNS CAN OCCUR IF LIQUID NITROGEN OR DRY ICE IS MISHANDLED.

   PROPER PROTECTIVE CLOTHING AND SAFETY EQUIPMENT MUST BE USED AT ALL TIMES.
5. Warm the Seat Cartridge to a temperature not to exceed 250º degrees F.
6. Place the warm Seat Cartridge on its side with the empty Seat Pocket facing up. Working quickly, remove one of the Seats from the liquid nitrogen (or dry ice) and drop it into the Seat Pocket, holding it in place until the frost melts. Make sure that the seat is firmly and squarely bottomed out in the pocket of the cartridge.
7. Turn the Seat Cartridge over, and repeat the Seat installation process as described in Step 6
8. Once the assembly has stabilized in temperature, verify that the two Seats are parallel within .003" TIR, and the distance between the seat faces falls within the SEAT SPREAD dimensions as shown in the Table below. Use a telescoping gauge or other measuring device to measure the distance between the seat faces.



SEAT FACE-TO-FACE DIMENSIONS

VALVE SIZE	SEAT SPREAD	VALVE SIZE	SEAT SPREAD
1/4"	.265" to .275"	2-1/2"	2.544" to 2.559"
3/8"	.390" to .400"	3"	3.048" to 3.063"
1/2"	.515" to .525"	4"	4.052" to 4.067"
3/4"	.765" to .775"	6"	6.075" to 6.090"
1"	1.018" to 1.028"	8"	8.112" to 8.142"
1-1/4"	1.275" to 1.285"		
1-1/2"	1.526" to 1.536"		
2"	2.044" to 2.058"		

SEAT LAPPING INSTRUCTIONS

These instructions are to be followed when changing the upstream seat to the downstream seat (by rotating the installed cartridge 180 degrees). Any seat which is installed into the cartridge in the field will also require lapping. Cartridge assemblies supplied by DFT do not require lapping prior to assembly.

Recommended Lapping Procedure for Cartridge Assemblies Supplied by the DFT Factory

- **No lapping is required. Cartridge assemblies provided by the DFT factory have been fully lapped and vacuum tested.**

Recommended Procedure for Checking New Seats

1. New seats supplied from the DFT factory have already been lapped prior to shipment.
2. Install the new Seats into the Seat Cartridge as detailed in Appendix A.
3. Apply a light film of Layout Bluing (i.e.: DYKEM, Hi-Spot Blue No. 107) on the Ball, and position the Ball in the Downstream Seat. Applying light pressure by hand, rotate the Ball 90° and back to transfer Bluing to the Seat. There should be a thin continuous ring of Bluing around the Seat circumference near the Seat bore. If the bluing does not show a continuous ring with a consistent width, the Seat will have to be lapped.

Recommended Lapping Procedure for New Seats

- **This lapping process should be followed after the seat is inserted into the cartridge and parallelism has been checked as detailed in Appendix A.**

1. Use the correct size lapping ball supplied by DFT. The complete tool consists of a nut welded to the ball and a bolt which can be threaded into the nut.
2. Apply 1000 grit lapping compound to the seating surface.
3. Insert the tool through the top (or bottom) of the cartridge assembly. Press down through the opposite seat to apply pressure to the lapping ball.
4. Lap the seat by moving the bolt back and forth (through approximately a 45° angle) while applying “hand” pressure.
5. The seat should lap in to show a continuous ring with a consistent width within 10 minutes. If it does not, a heavier grit may be required.
6. Thoroughly clean the seat, the cartridge assembly and the lapping ball using a suitable solvent.

Recommended Lapping Procedure for Used Cartridge Assemblies

- **This lapping process should be followed after removing the cartridge assembly from the valve body. If both seats have been used as the downstream seat, they should be replaced.**
- **If the upstream seat has not been used as the downstream seat, the seats can be switched** (by rotating the installed cartridge 180 degrees)**. Use the lapping procedure for new seats to lap the upstream seat, then install it as the new downstream seat.**

Slightly Damaged Seats

- Valve leakage may be due to minor damage to the Seat. This damage may be correctable by lapping rather than replacement with a new Seat. Generally, cuts, scratches and damage not more than .005" deep can be removed by lapping. More extensive damage normally warrants seat replacement.

Recommended Lapping Procedure for Slightly Damaged Seats

- **This lapping process should be followed after the cartridge has been removed from the valve.**

1. Use the correct size lapping ball supplied by DFT. The complete tool consists of a nut welded to the ball and a bolt which can be threaded into the nut.
2. The lapping sequence continues in the same manner using progressively finer grit lapping compounds, until a suitable seating surface finish is obtained. At DFT, Loctite Clover Lapping Compounds are used for lapping Valve Seats:
    - The initial lap is completed using 80 grit.
    - The second lap is completed using 180 grit.
    - The third lap is completed using 240 grit.
    - The finishing lap is completed using 1000 grit.
3. Each time a change is made to the next finer grit, the Seat and Lapping Ball must be thoroughly cleaned in a suitable solvent.
4. Insert the tool through the top (or bottom) of the cartridge assembly. Press down through the opposite seat to apply pressure to the lapping ball.
5. Lap the seat by moving the bolt back and forth (through approximately a 45° angle) while applying "hand" pressure.
6. The seat should lap in to show a continuous ring with a consistent width for each step within 10 minutes.
7. Thoroughly clean the seat, the cartridge assembly and the lapping ball using a suitable solvent.

Appendix B

Guide Pin Adjustment

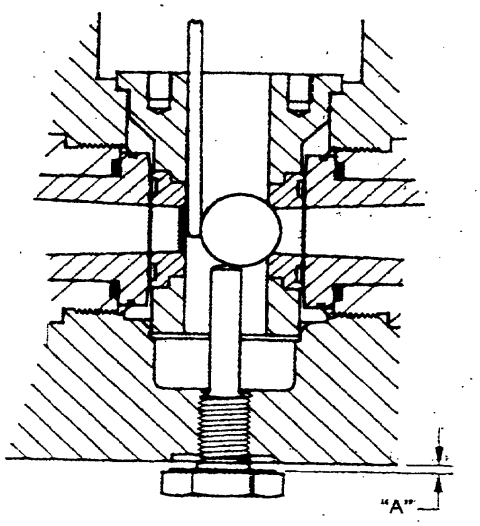
CAUTION: Failure to properly set the Guide Pin clearance may restrict the Valve closing, and cause damage to the Guide Pin.

To facilitate proper adjustment, all replacement Guide Pins shipped from DFT (for valves manufactured prior to 2016) will be furnished slightly longer than is required. It may be necessary to adjust the overall length of the Pin length after the Guide Pin is installed. To adjust the Guide Pin length, and set the proper gap between the Ball and the top of the Guide Pin, the following is recommended:

1. Remove the Bonnet, Stem and Cage from the top of the Valve. Insert the Ball into the Seat, and hold in place.
2. With the Guide Pin seal removed, screw the Guide Pin into the Valve Body until it makes light contact with the Ball.
3. Measure the gap between the Guide Pin shoulder and the bottom of the Valve Body (See illustration below). Record this as dimension "A".
4. Add dimension "A" to the required clearance shown in the Guide Pin Clearance Table below. Record this as dimension "B".
5. Remove the Guide Pin from the Valve Body.
6. Remove material from the tip of the Guide Pin equal to the recorded Dimension "B". To shorten the Guide Pin length, and increase the gap between the ball and guide pin, use a flat file or an air grinder. **NOTE: The blunt spherical radius of the Guide Pin tip must be closely maintained**.
7. Apply a lubricant to the Guide Pin Seal and place it onto the Guide Pin (Lithium grease for gaskets or a Silicone based lubricant for O-Rings). Apply anti-seize compound to the threads of the Guide Pin and screw it into the Valve Body.

Guide Pin Clearance Dimensions

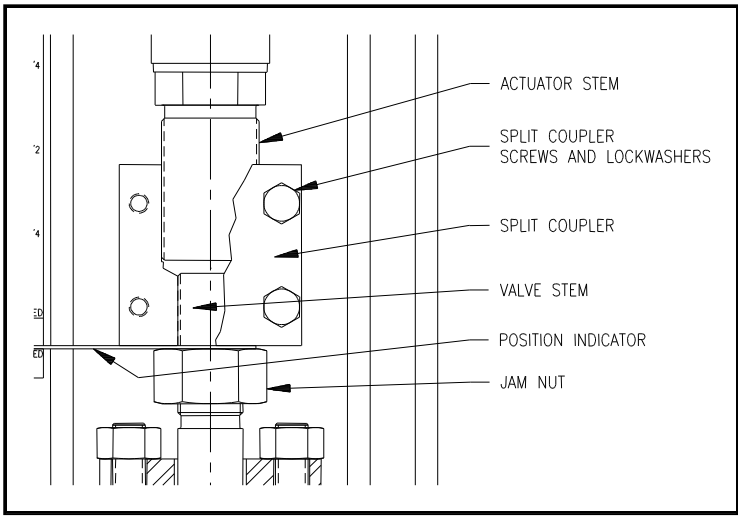
Valve Size	Required Clearance
1/4"	.010" to .015"
1/2" to 1"	.020" to .030"
1-1/4" to 2"	.025" to .035"
2-1/2" to 6"	.030" to .045"
8" and Larger	.040" to .060"



Appendix C

SPLIT COUPLER ADJUSTMENT

The DFT HI-100 Control Valve uses a Split Coupler stem connector for connecting the Valve Stem to the Actuator Stem. This type of connector is common for Control Valves that are actuated by a Diaphragm or Piston style Actuator.



Valves Manufactured Prior to June 2016

The DFT Split Coupler features left hand and right hand threads for final adjustments during assembly. The thread on the Valve Stem is a left-handed thread; whereas, the Actuator Stem thread is normally a right-handed thread. If the stem connection on your valve is different than that described, contact the DFT Engineering Department at 610-363-8903, for special instructions. By turning the Split Coupler clockwise the Valve Stem and Actuator Stem are separated, and by turning the Split Coupler counter-clockwise they are pulled together. The lengthening and shortening effect changes the relationship of the Ball and Cage to the Seat.

Valves Manufactured After June 2016

The split coupler provided with your valve has both threads (Valve Stem and Actuator Stem) being right handed. The stem connection is round allowing you to rotate the stem to adjust the stem/actuator connection as needed. On the stem there are flats to allow a wrench to be used to rotate the stem.

NOTE: All DFT HI-100 Control valves are adjusted at the factory prior to shipment and should not require resetting until the valve is disassembled. If it is necessary to change the valve setting, the instructions in this section will guide you through the proper steps. Failure to properly adjust the Valve Stroke and Split Coupler could result in valve damage. If the actuator has not been removed you should not need to reset/adjust the split coupler.

Removal of the Split Coupler

CAUTION: VERIFY THAT THE VALVE STEM AND ACTUATOR STEM ARE NOT UNDER TENSION. IF THE VALVE IS EQUIPPED WITH A FAIL OPEN ACTUATOR, THE VALVE STEM AND ACTUATOR STEM WILL BE IN TENSION. IT IS THEREFORE RECOMMENDED THAT THESE VALVES BE HELD IN THE CLOSED POSITION (OR SOME INTERMEDIATE POSITION) WITH THE POWER SOURCE WHILE REMOVING THE SPLIT COUPLER.

CAUTION: FAILURE TO PROPERLY RELIEVE THE STEM TENSION COULD RESULT IN PERSONAL INJURY.

Removal of the Split Coupler (con't)

1. Loosen the Jam Nut under the Split Coupler.
2. Remove the Hex Head Bolts that are holding the two halves of the Split Coupler together.
3. With the flat blade of a screwdriver, pry the two halves apart and remove them from the Valve Stem and Actuator Stem.
4. Remove the Position Pointer and any other actuating levers or feedback linkages that may be present. Thread the Jam Nut off of the Valve Stem.

Installation of the Split Coupler

NOTE: DFT Control Valves are position seated. If the valve is hard seated, premature failure will occur. Properly following this procedure assures that the Ball does not contact the Guide Pin during normal operation.

1. Prior to assembly, take time to examine the threads on the Valve Stem and Actuator Stem for possible damage. The threads should be clean and free of defects.
2. Stroke the valve manually to insure the Ball, Cage and Valve Stem are operating freely. Manually push the Valve Stem to the fully closed position. Extreme force will not be required; however, sufficient force should be applied to insure the Ball is firmly seated.
3. Apply a high temperature anti-seize thread lubricant to the Valve Stem thread and the Actuator Stem thread. Thoroughly clean the threads of the two Split Coupler halves and apply thread lubricant.
4. Install the Jam Nut, Position Indicator and any other actuating levers onto the Valve Stem. Screw the Jam Nut all the way down. Remember that this is left hand thread.
5. Carefully examine the threads in the Split Coupler halves to insure the larger threads mate with the Actuator Stem and the smaller threads mate with the Valve Stem threads.
6. With the Actuator Stem in the fully extended position, fit one of the Split Coupler halves onto the shafts. **This Split Coupler position should be 180 degrees from the desired final orientation.**

   NOTE: It is critical that the actuator is in the fully extended position for proper set up.
7. The fit-up of the Split Coupler to the Valve Stem and Actuator Stem should be made so there is an equal distribution of thread engagement on both connecting shafts. To insure the threads are properly seated, it may be necessary to slightly rotate the Split Coupler half while

pulling it into the threaded shafts. Care should be taken to insure the Valve Stem position is not changed during this fit-up.

8. Install the other Split Coupler half and secure the assembly using the Hex Head Bolts. Do not tighten the bolts at this time.

Setting the Valve Stroke (Manufactured Prior to June 2016)

NOTE: The Actuator Stem and Valve Stem must be in the closed position prior to setting the valve stroke. Position the Split Coupler 180 degrees from the desired final orientation.

1. Snug the Split Coupler bolts with your fingers.
2. Using your hand, rotate the Split Coupler clockwise (this increases the spread between the actuator stem and the valve stem) until you feel the ball contact bottom (this is the guide pin).

CAUTION: Do not apply more force than can be applied by hand; on larger valves where a wrench may be required, do not apply more than 10-15 ft./lbs. torque. DO NOT OVER TORQUE.

3. Now rotate the Split Coupler 180 degrees (1/2 turn) counter-clockwise (this decreases the gap between the Actuator Stem and Valve Stem) to its final position. This rotation releases the load between the ball and the guide pin.

NOTE: If you rotate the Split Coupler more than 360 degrees at this time (1 full turn), restart the procedure.

4. Securely tighten the Split Coupler Hex Head Bolts. Tighten the jam nut (left hand thread) up against the Position Indicator at the bottom of the Split Coupler.
5. Stroke the valve again to insure smooth operation throughout the entire stroke range.
6. Any accessory instrumentation (i.e. - Positioner, Limit Switches, etc.) can now be adjusted and calibrated based on the full stroke of the valve.

Setting the Valve Stroke (Manufactured After June 2016)

1. Snug the Split Coupler bolts with your fingers.

2. Using a wrench, rotate the Stem clockwise (this increases the spread between the actuator stem and the valve stem) until you feel the ball contact bottom (this is the guide pin).

CAUTION: Do not apply more force than can be applied by hand; on larger valves where a wrench may be required, do not apply more than 10-15 ft./lbs. torque. DO NOT OVER TORQUE.

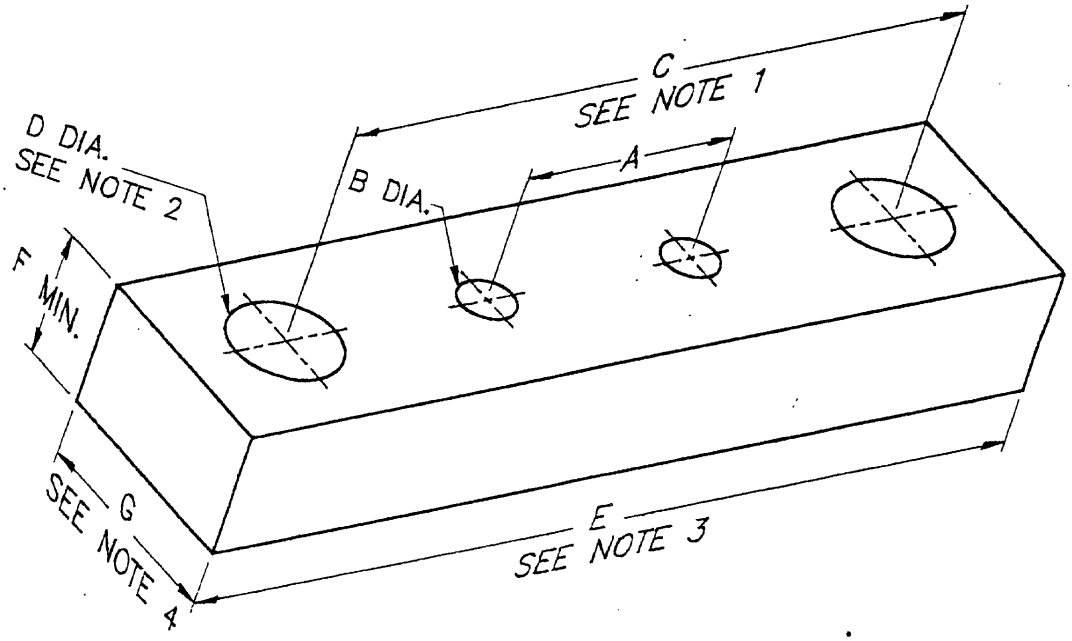
3. Now rotate the Stem 720 degrees (2 turns) counter-clockwise (this decreases the gap between the Actuator Stem and Valve Stem) to its final position. This rotation releases the load between the ball and the guide pin.

4. Securely tighten the Split Coupler Hex Head Bolts. Tighten the jam nut up against the Position Indicator at the bottom of the Split Coupler.
5. Stroke the valve again to insure smooth operation throughout the entire stroke range.
6. Any accessory instrumentation (i.e. - Positioner, Limit Switches, etc.) can now be adjusted and calibrated based on the full stroke of the valve.

Appendix D

Seat Cartridge Removal and Installation Tool

The following is merely a guide to assist in preparing a tool for the purpose of removal and installation of the Seat Cartridge.

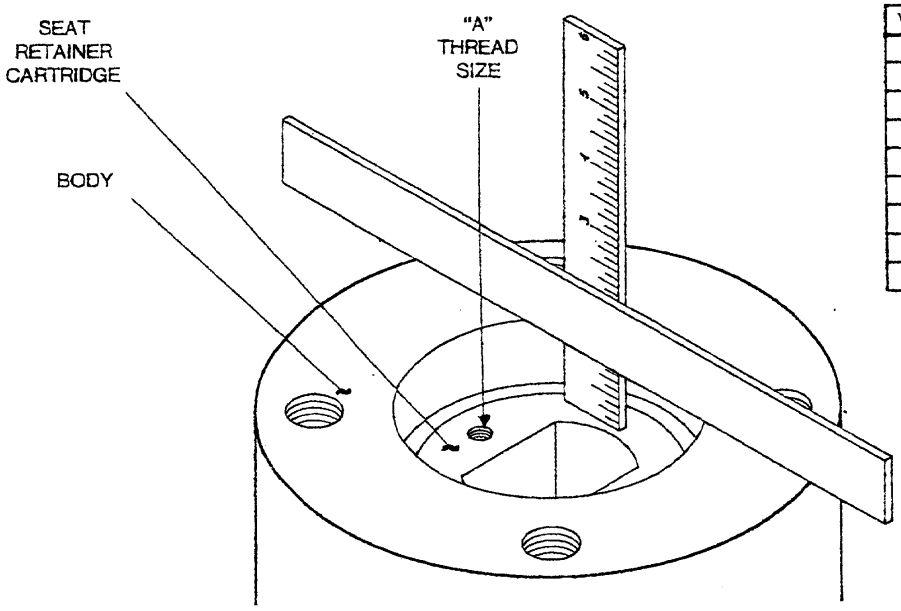


VALVE SIZE	DIMENSION						
	A	B (Dia)	C	D	E	F (min)	G (min)
1/4”	1”	3/16”	-	-	-	3/4”	-
1/2”	1”	3/16”	-	-	-	3/4”	-
3/4”	1-1/2”	5/16”	S	S	S	3/4”	S
1”	1-3/4”	3/8”	E	E	E	1”	E
1-1/4”	2-1/8”	7/16”	E	E	E	1”	E
1-1/2”	2-1/2”	7/16				1”	
2”	3-3/16”	5/8”	N	N	N	1-1/2”	N
2-1/2”	3-3/4”	5/8”	O	O	O	1-1/2”	O
3”	4-1/2”	5/8”	T	T	T	2”	T
4”	6”	3/4”	E	E	E	2”	E
6”	8-3/8”	7/8”				2”	
8”	11-1/2”	1”				2-1/2”	
10”	12-3/4”	1-1/8”	1	2	3	2-1/2”	4
12”	15-3/4”	1-1/8”	-	-	-	3”	-
14”	18”	1-1/8”	-	-	-	3”	-

NOTES:

1. Measure the Bottom Cover or Bonnet bolt circle on the body. The “C” dimension is the same as the bolt circle.
2. Measure the Bottom Cover or Bonnet Studs, and drill these holes 1/16” larger than the stud diameter.
3. Measure the Body width, and cut the bar slightly longer than the span across the body.
4. Width “G” should be approximately 1/2” larger than drill diameter “D”.

Determining Allthread Size and Length



VALVE SIZE	"A"
1/4"-1/2"	#10-24 UNC
3/4"	1/4"-20 UNC
1"	5/16"-18 UNC
1¼"-1½"	3/8"-16 UNC
2"-2½"-3"	1/2"-13 UNC
4"	5/8"-11 UNC
6"	3/4"-10 UNC
8"	7/8"- 9 UNC
10"-12"-14"	1"- 8 UNC

Notes:

1. The thread size for the allthread is shown in the Table above.
2. To determine the length required, measure from the top of the Seat Cartridge to the top of the Valve Body (as shown above). Add to this dimension “F” from the previous page plus 2”.

Appendix E

BOLTING TORQUE

A torque wrench should be used for tightening the pressure vessel bolting used on the DFT Valves.

FASTENER SIZE (Inches)	THREADS / INCH (UNC)	TORQUE VALUE - (Ft-Lbs)
1/2	13	30
9/16	12	45
5/8	11	60
3/4	10	100
7/8	9	160
1	8	245
1-1/8	8	355
1-1/4	8	500
1-3/8	8	680
1-1/2	8	800
1-5/8	8	1100
1-3/4	8	1500

These values are based on using a high temperature thread lubricant. The threads as well as the fastener head bearing surface must be lubricated.

Fastener torque values should be applied in incremental steps. Apply a steady, even pull to the torque wrench handle and follow a staggered star pattern when torquing.

NOTE: To guard against leakage, it is good practice to check and verify the torque for all pressure vessel bolting once the valve is brought up to normal operating pressure and temperature.