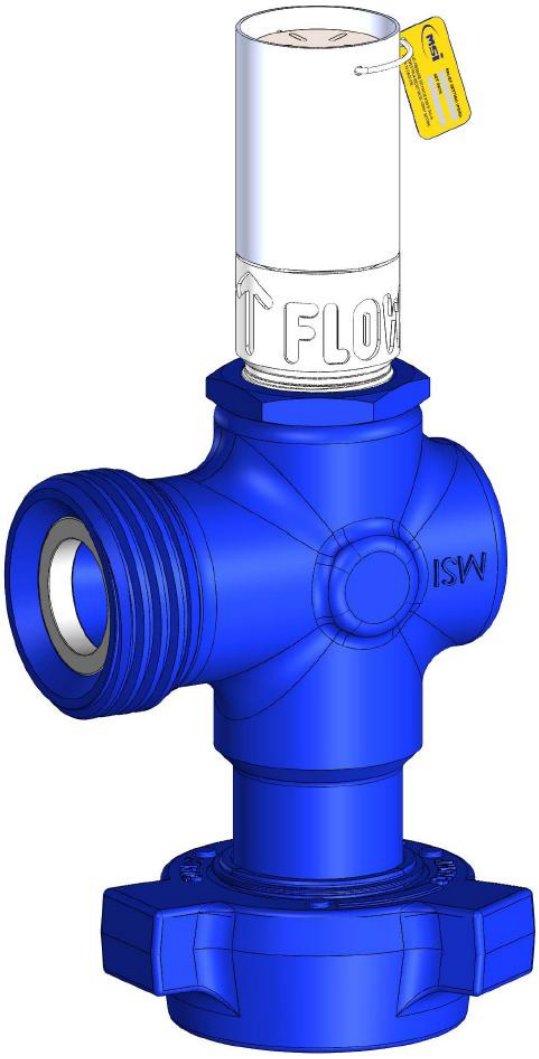
Technical Manual

MSI Pressure Relief Valve



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SECTION 1 WARNINGS

The MSI Pressure Relief Valve is used in high-pressure service applications. High pressure equipment, if not used and maintained properly, can cause serious injury or death and damage to equipment and property. Not taking proper precautions and failing to perform routine maintenance and inspections can also contribute to loss of pressure relieving capabilities, and such loss could cause serious injury or death and damage to equipment and property.

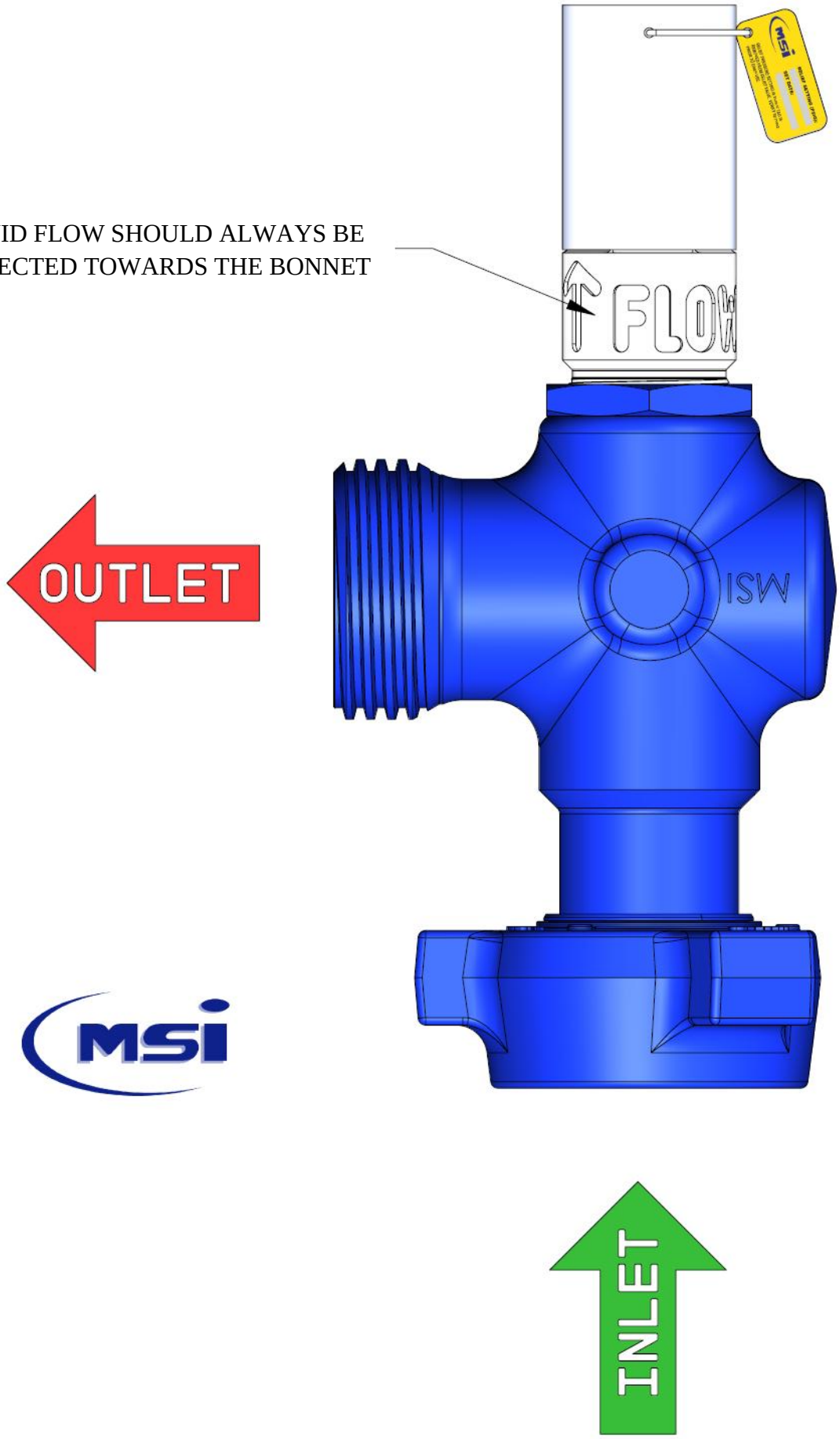
ALL OPERATORS AND MAINTENANCE PERSONNEL SHOULD BE THOROUGHLY TRAINED IN THE SAFE OPERATION, MAINTENANCE, AND INSPECTION OF THIS EQUIPMENT.

Operational Warnings:

1. Never make relief pressure setting adjustments to the relief valve during operation (see Section 5). Such practice or improper use could result in serious injury or death and/or damage to equipment.
2. The relief valve is not a full bore flow-through relief valve, as it's not designed to open fully. Therefore if large volumes of fluid must be relieved other measures should be considered.
3. Precautions should be taken to prevent debris from settling in the inlet bore of the relief valve. Failure to do so could result in the valve not relieving properly and/or not closing properly and leaking after a relieving event.
4. The rated working pressure of the valve should not be exceeded during operation.
5. The relief pressure setting should be verified prior to each use.
6. STD service equipment should not be exposed to H2S.
7. Never hammer a union connector while pressurized.

FLUID DIRECTION THROUGH RELIEF VALVE

FLUID FLOW SHOULD ALWAYS BE DIRECTED TOWARDS THE BONNET



SECTION 2 GENERAL DESCRIPTION

2.1 Relief Valve Description

The MSI Pressure Relief Valve is designed to provide over-pressure protection for high pressure equipment up to 15,000 psi. It is primarily used as a buffer against discharge pressure spikes encountered during fluid pumping operations. The pressure relieving design incorporates a spring loaded ball that seals against a seat. When the relieving pressure is reached, the spring force is overcome and the ball separates from the seat. This ball movement allows fluid to exit the relief valve, therefore keeping the pressure from increasing. Fluid exiting the relief valve consequently warns the user that the preset relieving pressure has been reached. The relief valve will reseat once the line pressure has dropped to a value below the relieving pressure.

Note: The relief valve is not a full bore flow-through relief valve, as it's not designed to open fully. Therefore if large volumes of fluid must be relieved other measures should be considered.

An adjustment screw provides the means of adjusting the pressure relief setting. Although it is preferred that this be done at the factory, the relief valve can also be adjusted in the field. The default factory pressure relieving setting is 12,500 psi. If the relief valve is adjusted in the field, it then becomes the user's responsibility to ensure that the required relief pressure is set correctly before using it.

2.2 Relief Valve Specifications

The components are made from various materials strategically:

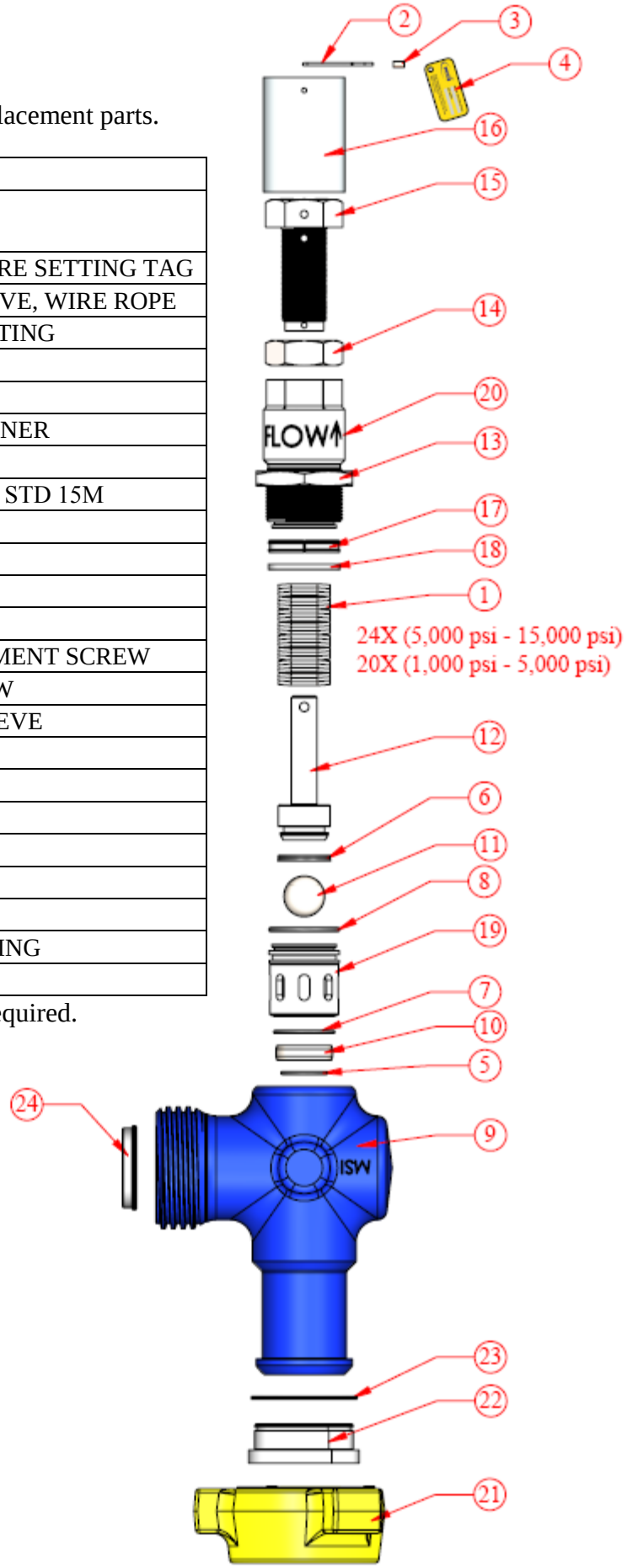
- Body – alloy steel forging
- Ball – tungsten carbide (other materials available upon request)
- Seat – stainless steel (other materials available upon request)
- Plunger – stainless steel
- Bonnet – stainless steel
- Adjustment Screw – alloy steel

3.1 Exploded View

See the following drawing and bill of materials for replacement parts.

ITEM#	QTY	PART #	DESCRIPTION
1	24 (15M) 20 (5M)	HC0852	SPRING
2	1	HC0914	WIRE ROPE, PRESSURE SETTING TAG
3	1	HC0915	COMPRESSION SLEEVE, WIRE ROPE
4	1	HC0916	TAG, PRESSURE SETTING
5	1	OC0162	O-RING, SEAT
6	1	OC0163	PLUNGER SEAL
7	1	OC0164	O-RING, SEAT RETAINER
8	1	OC0173	O-RING, CAGE
9	1	*RVC0001	RV BODY, 2”1502 FM STD 15M
10	1	RVC0002	SEAT
11	1	RVC0004	BALL
12	1	RVC0005	RV PLUNGER, 2”
13	1	RVC0007	JAM NUT, BONNET
14	1	RVC0008	LOCK NUT, ADJUSTMENT SCREW
15	1	RVC0009	ADJUSTMENT SCREW
16	1	RVC0010	LOCK AND TAG SLEEVE
17	1	RVC0015	SPLIT-CLAMP
18	1	RVC0016	RETAINER RING
19	1	RVC0017	CAGE
20	1	RVC0018	BONNET
21	1	*UC0002	WINGNUT
22	1	*UC0003	NUT RETAINER SET
23	1	*UC0004	SPIRAL RETAINER RING
24	1	*UC0011	RESILIENT SEAL

*Items will vary depending on connections required.



SECTION 4 MAINTENANCE

4.1 Preventative

The relief valve will need periodic inspections to ensure that the assembly is still in good working condition. If the relief valve is frequently relieving while in service, slight changes to the relief pressure setting might occur gradually. To ensure that the valve is still calibrated correctly to the desired relief pressure, it is recommended that the valve relief pressure setting be verified prior to each use. **Never** make adjustments to the relief valve pressure setting while under pressure (see Section 5 for proper procedure).

It is important to inspect the valve for leakage while in service. If any leakage is detected, the relief valve should be taken out of service and rebuilt with new MSI components.

4.2 Disassembly

Warning: Ensure there is no pressure in the system before starting disassembly. Disassembly while under pressure can cause serious injury or death and/or damage to equipment.

1. Remove the **lock and tag sleeve** by cutting the **wire rope** off
2. Loosen the **adjustment screw lock nut** and remove the **adjustment screw**
3. Loosen the **bonnet jam nut** and remove the **bonnet** (the entire internal subassembly will be removed along with the **bonnet**)
4. Once outside of the **body**, remove the **retainer ring** and the **split-clamp** that connects **bonnet** and **cage**
5. Separate the **bonnet** from the **cage**
6. Remove the **springs**
7. Pull the **plunger** out of the **cage**

Note: If needed, the hole in the plunger can be used to insert a screw driver or rod to assist in the removal.

8. Remove the **ball**
9. Remove the **seat** from the **cage**

4.3 Inspection

After cleaning the parts, visually inspect for abnormal wear, corrosion, erosion, or any other physical damage. Replace damaged parts with MSI components only.

Note: Sealing surfaces should be free of scratches, dings, and/or pitting. Lightly buff out any light imperfections to improve sealing surface finish using a 600 grit sanding cloth that is well lubricated with water or solvent. Replace components if any wear or damage on the sealing surface is present.

Note: Threads should be inspected for any wear. If there is abnormal wear on the threads (such as a step on the thread flank), replace the component. Any burrs or nicks present need to be removed.

1. Inspect the **seat and ball** and replace as necessary. The ball and seat should be free from any surface damage (burrs, scratches, cracks, erosion…). The seat is symmetric. If one side is damaged, the seat can be reversed to provide a new sealing surface to seal against the ball.
2. Inspect the **body** for any wear/damage to the threads and sealing areas on the body (the internal diameter after the threads, and bottom surface of the pocket). Also look for any corrosion or erosion present.
3. Inspect the **cage** internal diameter (sealing surface) for any damage. Inspect the o-ring grooves for any damage.
4. Inspect the **plunger** for any damage to the seal groove and to the major diameter. There could be some minor damage to the spring-guide shaft surface, remove any burrs or nicks as necessary to prevent the springs from catching on the burrs. If excessive damage is present, replace the plunger.
5. Inspect the **springs** for excessive wear and/or corrosion. Replace as necessary.
6. Inspect the **bonnet** for any wear to the internal and external threads.
7. Inspect the threads of **adjusting screw**.
8. Replace the **wingnut** if the lugs are excessively deformed or damaged.

4.4 Kits Available

RVA0100: REPAIR KIT, RELIEF VALVE, STD

- OC0162: SEAT O-RING
- OC0163: PLUNGER SEAL
- OC0164: SEAT RETAINER O-RING
- OC0173: CAGE O-RING
- RVC0002: SEAT
- RVC0004: BALL
- HC0914: WIRE ROPE
- HC0915: WIRE ROPE SLEEVE
- HC0916: SETTING TAG

RVA0101: SEAL KIT, RELIEF VALVE, STD

- OC0162: SEAT O-RING
- OC0163: PLUNGER SEAL
- OC0164: SEAT RETAINER O-RING
- OC0173: CAGE O-RING

4.5 Assembly

Assembly consists of building the internal subassembly outside, then inserting it as a whole into the body.

Note: Always use general purpose grease to lubricate all parts thoroughly during assembly. Anti-seize grease should be used on parts when stated, especially on threads.

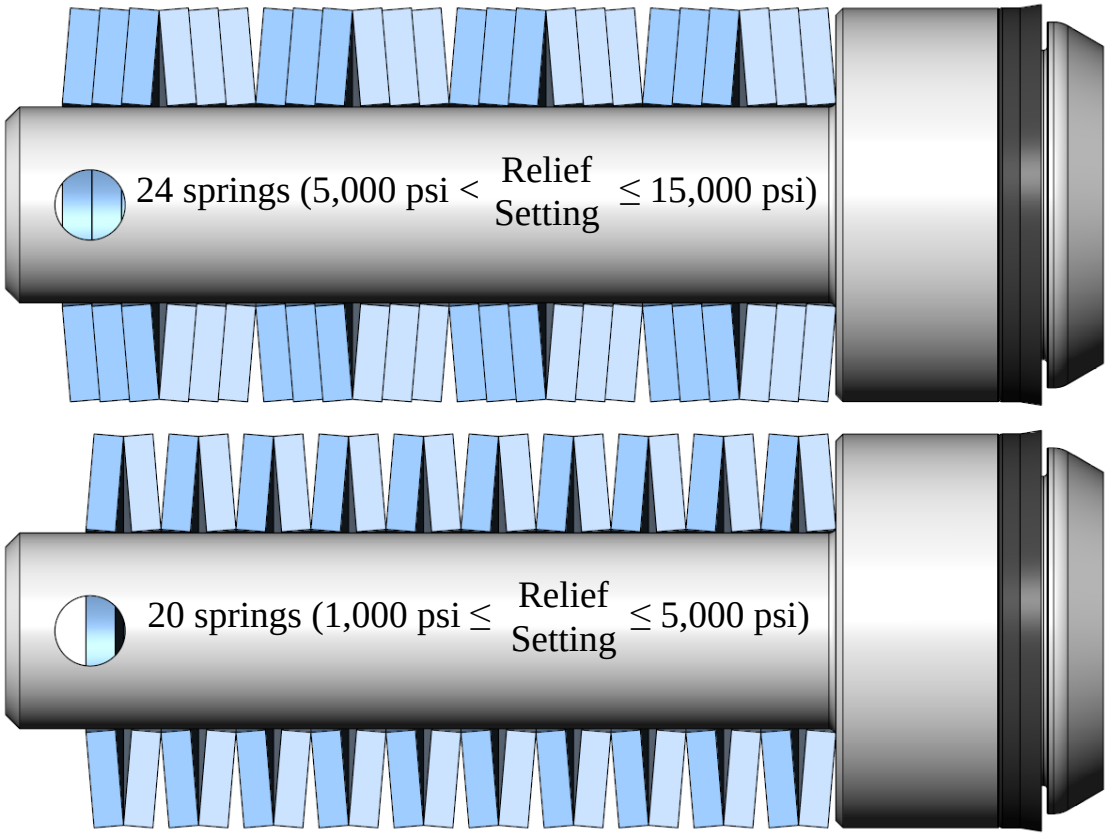
1. Lubricate the internal surfaces of the **body**.
2. Lubricate the **seat o-ring** and install on **seat**.
3. Lubricate the **seat retainer o-ring** and install in **cage**.
4. Lubricate the **seat** and install in **cage.**

Note: Since the seat is symmetric, if the seat is being reused, make sure that the "fresh" sealing surface is facing the inside of the cage.

5. Lubricate the **cage o-ring** and install on **cage**.
6. Carefully install **ball** inside of **cage** until it rests on the **seat**.
7. Lubricate and install **plunger seal** on **plunger**.

Note: Ensure that lip seal is not rolled inside the groove after installation, and that the lip is facing towards the ball end of the plunger. See image below.

8. Lubricate the internal surface of the **cage**.
9. Insert **plunger** inside of **cage**.
10. Apply anti-seize to the shaft of **plunger** where **springs** go.
11. Install **springs** on the **plunger** in the corresponding orientation depicted below:



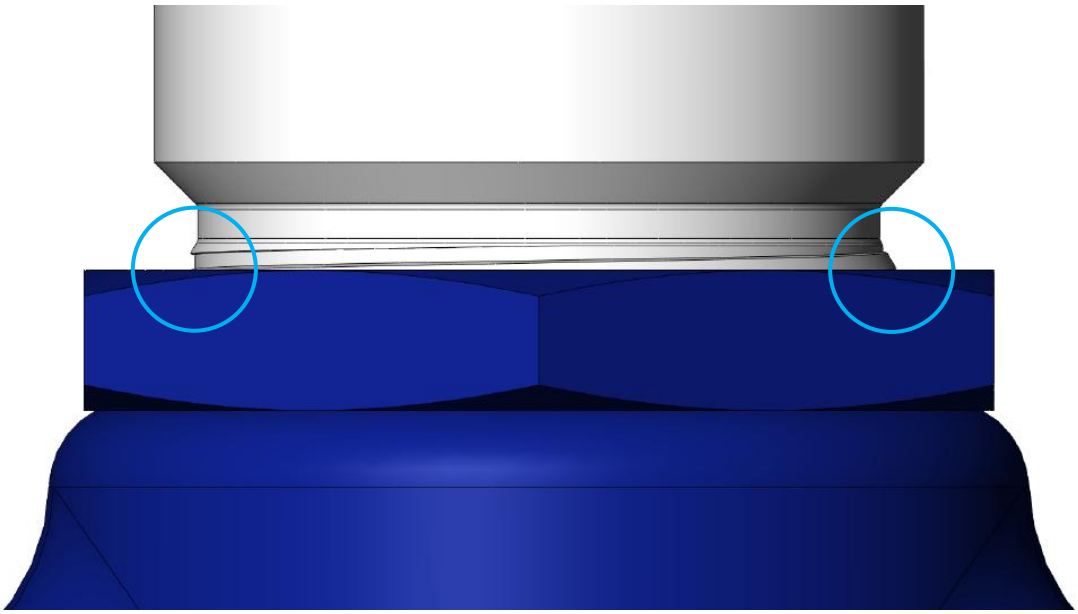
12. Ensure that the **bonnet** threads (internal and external) have sufficient anti-seize.
13. Install the **bonnet jam nut** on the **bonnet** all the way.
14. Slide the **bonnet** over the **springs** to position it next to the **cage.**
15. Install the **split-clamp** engaging grooves on both **bonnet** and **cage**.
16. Install the **split-clamp retaining ring**.
17. Lubricate the outside of **cage**.
18. Insert the internal subassembly into the **body**. Fully tighten the **bonnet**. See notes below:

Note: This step is crucial for proper assembly. To ensure that the face seal on the seat is fully compressed, ensure that the seat makes contact with the body. It will take approximately 1/5th of a turn on the bonnet, after it feels that the o-ring is being compressed, to physically bottom the seat against the body.

Note: Verify that the bonnet jam nut is still loose after the bonnet has been fully tightened. This will ensure that the bonnet jam nut did not prevent full bonnet engagement.

19. Thread the **bonnet jam nut** against the **body**. Fully tighten the **bonnet jam nut**.

Note: Verify that NO full threads of the bonnet are exposed past the bonnet jam nut surface. This check confirms correct assembly. See image:



20. Apply anti-seize to the **adjusting screw** threads and install **adjusting screw lock nut** fully.
21. Thread the **adjusting screw** into the **bonnet** until ***"hand-tight"***.
22. Refer to Section 5 for the relief pressure setting procedure to finalize the assembly.

SECTION 5 Operation

Relief Pressure Setting Procedure:

1. Secure the relief valve on the test stand.

Note: Before attempting to set the relief valve, ensure there is no pressure in the valve.

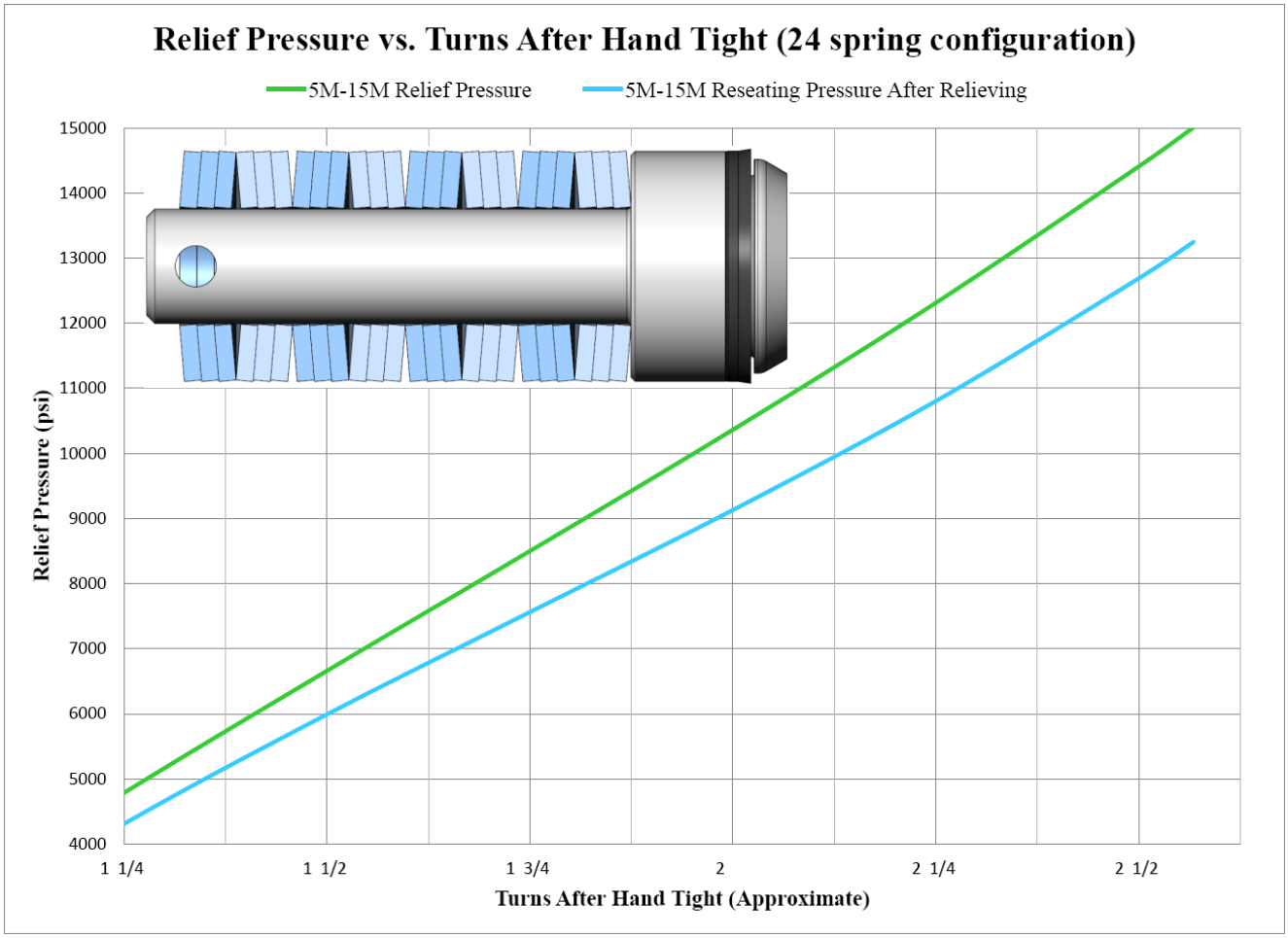
2. Thread the adjustment screw ***"hand-tight"*** until it bottoms out against the springs.
3. Using the following charts determine the approximate number of turns of the adjustment screw past ***"hand-tight"*** required to achieve the desired relief pressure.
4. Using the MSI Relief Valve Wrench (RVC0100), an adjustable wrench, or a 2 ¼" socket: rotate the adjustment screw **clockwise** (into the bonnet) as determined in previous step to preload the springs.
5. Apply pressure to the inlet side of the valve to test the relief pressure. If the relief pressure is incorrect, release the pressure and make small adjustments to the screw as required (see note below), and retest.

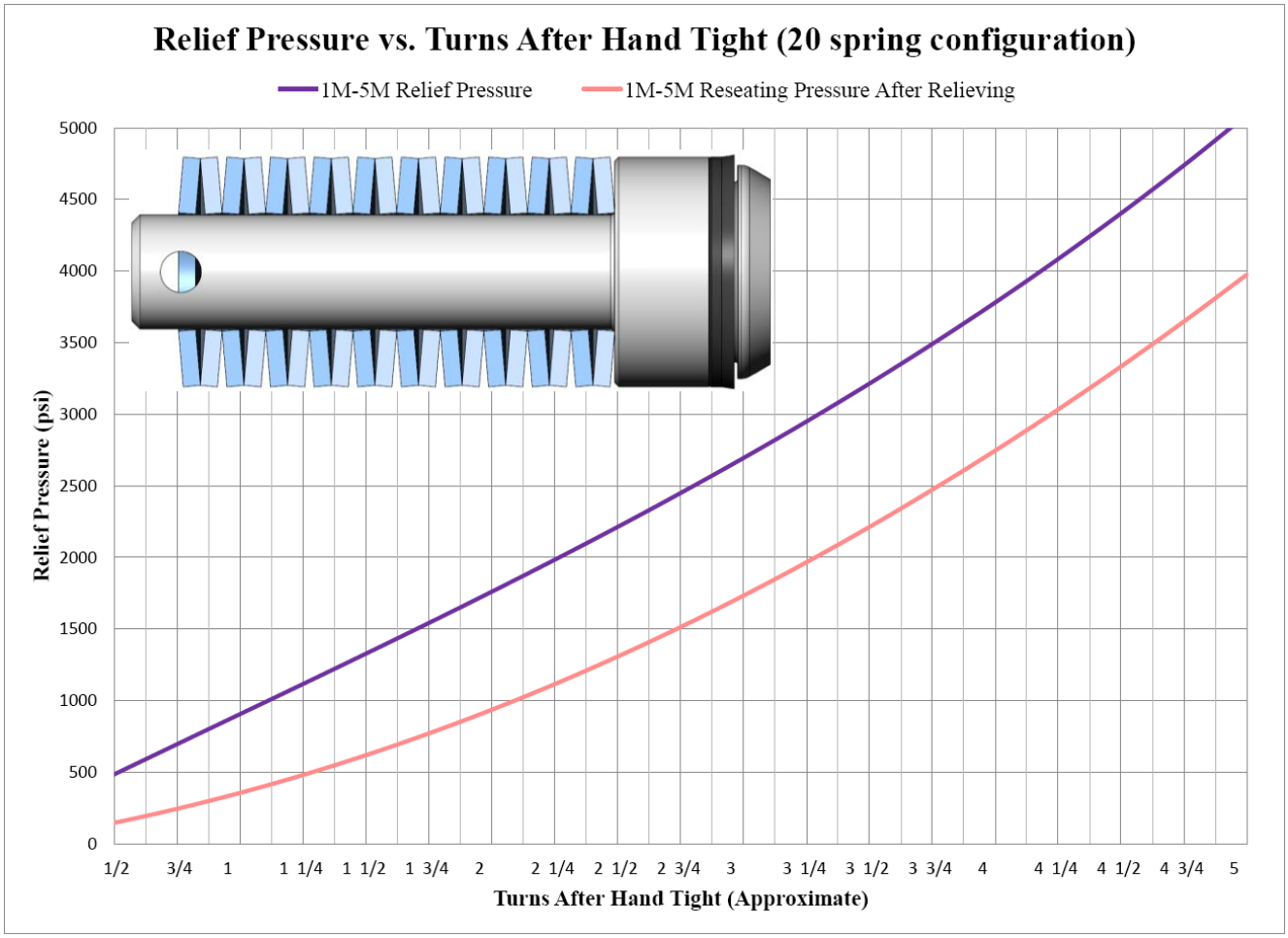
Note: Clockwise rotation on adjustment screw increases the spring preload and increases the relief pressure. Counter-clockwise rotation decreases the spring preload and the relief pressure.

6. Once the correct relief pressure has been achieved, fully tighten the adjustment screw locknut.
7. Using the wire rope, install the lock and tag sleeve and the preset pressure setting tag.
8. Relief valve is ready for use.

Note: Precautions should be taken to prevent debris from settling in the inlet bore of the relief valve. Failure to do so could result in the valve not relieving properly and/or not closing properly and leaking after a relieving event.

The relief valve will open to relieve pressure at the calibrated pressure setting. However, after the relieving event is over, it will be necessary for the pressure to drop below the relief pressure setting for the ball to reseat and hold pressure again. The approximate reseating pressure can be determined using the following charts for the corresponding spring configuration and relief pressure.


Relief Pressure vs. Turns After Hand Tight (24 spring configuration)
5M-15M Relief Pressure
5M-15M Reseating Pressure After Relieving
Relief Pressure (psi)
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
1 1/4
1 1/2
1 3/4
2
2 1/4
2 1/2
Turns After Hand Tight (Approximate)


Relief Pressure vs. Turns After Hand Tight (20 spring configuration)
1M-5M Relief Pressure
1M-5M Reseating Pressure After Relieving
Relief Pressure (psi)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1/2
3/4
1
1 1/4
1 1/2
1 3/4
2
2 1/4
2 1/2
2 3/4
3
3 1/4
3 1/2
3 3/4
4
4 1/4
4 1/2
4 3/4
5
Turns After Hand Tight (Approximate)

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