3.26 MSRV

The Expro Group have designed and developed an innovative safety feature, the M.S.R.V. (Multi Sensor Relief Valve) providing the optimum protection for hostile environment process systems.

The revolutionary M.S.R.V. is a rapid acting relief valve without the limitations of existing safety valves, allowing a greater flexibility in safety system design. In an overpressure situation the M.S.R.V. will respond through utilisation of its safety logic and protect the whole system.

The M.S.R.V. is a hydraulically operated ball valve actuated by well pressure from primary sensor points. Protection is achieved through constant monitoring of the process pressure at the respective sensor points.

The impulse sensors comprise of a high pressure lockable valve and coupling containing an interchangeable rupture disc.

When the process pressure exceeds a pre-determined value the disc ruptures and the respective impulse line is energised and the valve is opened.

Once actuated the M.S.R.V. will remain open until pressure is applied to the respective closure port.

SPECIFICATIONS	
Maximum Working Pressure	10,000 psi
Operating Temperature	-25deg F to 300deg F
Service Conditions	H2S, CO2
Outer Diameter	7.7 inches
Internal Diameter	Ball – 2.0 inch
Overall Length	24.00”
Effective Flow Area	Orifice – 3.14 Sq Inches (standard) (orifice interchangeable, sized to required specification)
Inlet/Outlet Connections	To required specification

CERTIFICATION
Bureau Veritas Design Approval - SI 289, API 6A

- **High Relief Capacity**
  High Flow Rate Discharge Capability.

- **Insensitive to System Back Pressure**
  In contrast to conventional and bellow type valves the M.S.R.V. is unaffected by back pressure.
  Allows use of smaller diameter pipework.

- **Positive Acting with No Simmering or Chattering**
  Nature of opening is impulsive due to the operating piston being directly responsive to the process pressure.

- **Accurate Setpoint Pressure**
  Calibrated rupture disc ensures accurate opening at the pre-determined setting.

- **Extreme High Pressure Integrity**
  High pressure integral ball valve and impulse system.

- **Multi Sensor Facility**
  Each valve has four impulse ports giving the ability to monitor the process pressure and protect a plurality of specification breaks.

- **Multi Operable Capability**
  In the event of activation the M.S.R.V. can be safely and reliably reset onsite. Simplicity in resetting of system only requires closure of the valve and replacement of single rupture disc.
  Integrity of system retained and confirmed by onsite pressure testing.

- **ESD Control Logic**
  During actuation a repeat impulse can be sent to an SDV and isolate the well.

FIGURE 3.26.1 – MULTI SENSOR RELIEF VALVE SAFETY HEAD

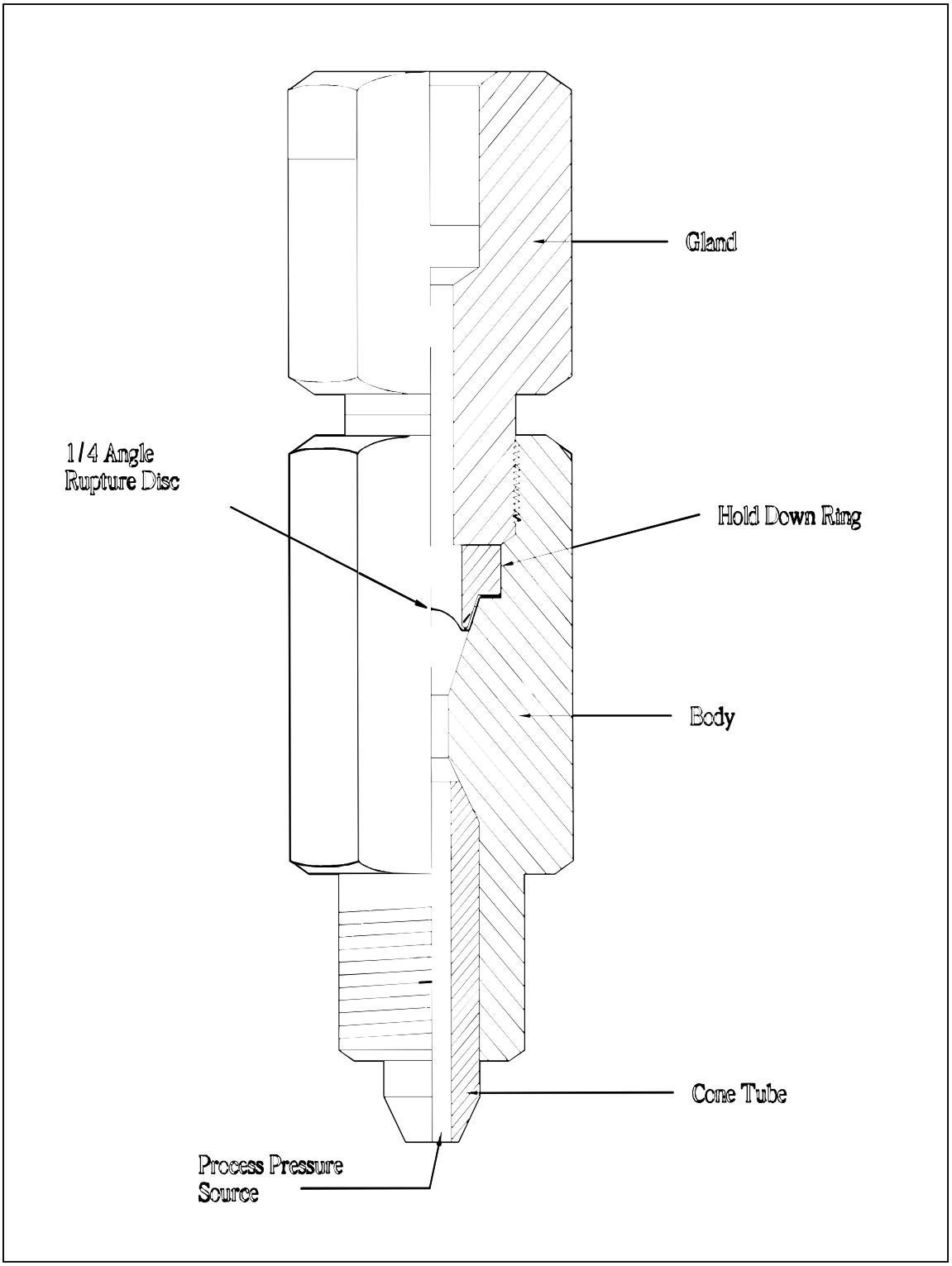
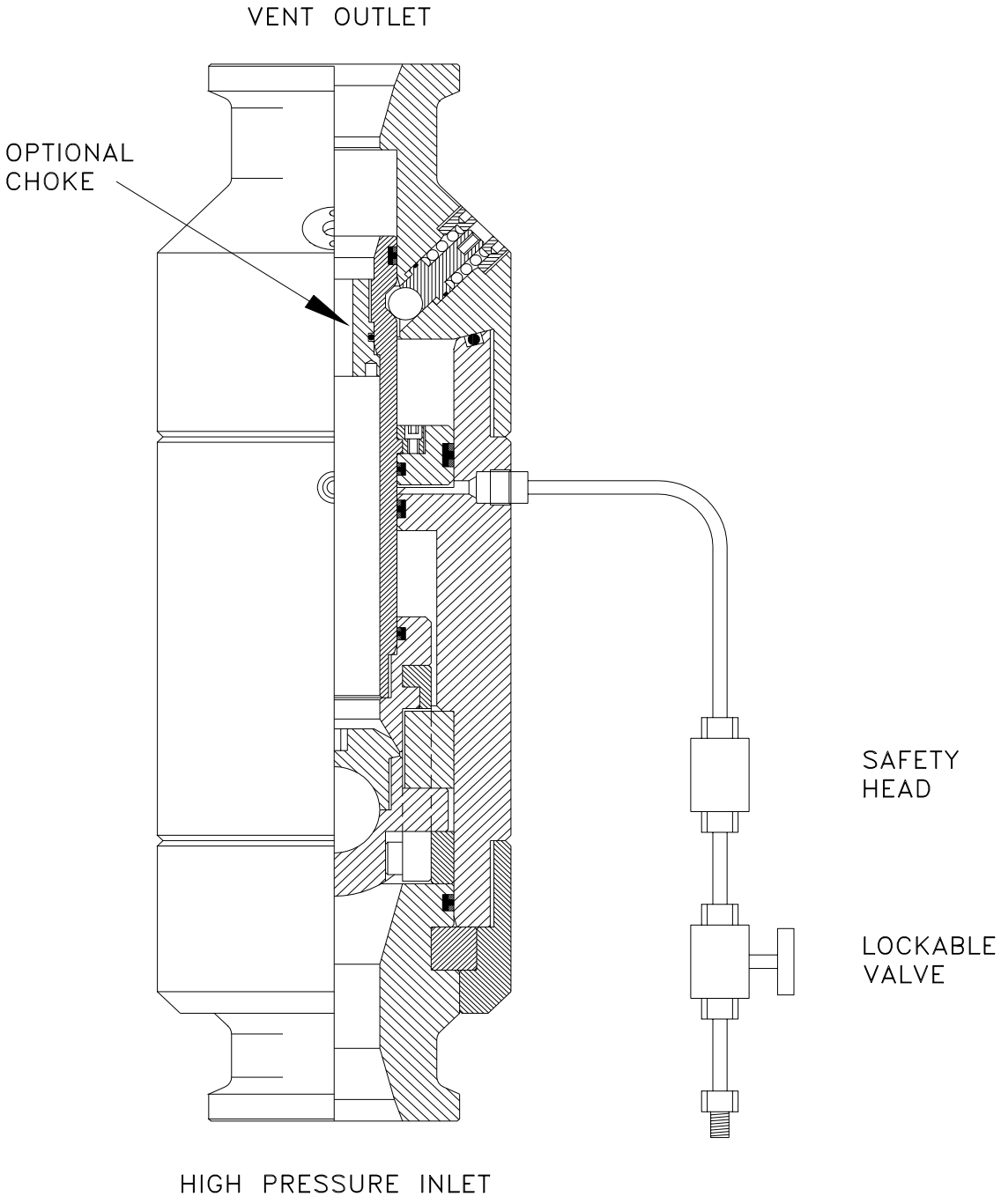


FIGURE 3.26.2 - MSRV



DIS-ASSEMBLY PROCEDURES

1. Unscrew end cap (TED180106) from main housing (TED180102). End sub 'B' (TED180104) should be eased out of main housing (TED180102) as end cap (TED180106) is unscrewed.
2. Remove split ring quarters (TED180107) from end sub 'B' (TED180104) and slide off end cap (TED180106).
3. Insert assembly tool (TED180122) into ball cage (TED180109) drilled holes and unscrew ball seat (TED180108) from mandrel (TED180105).
4. Insert 2 x 1/4" UNC Screws into ball cage (TED180109) tapped holes and remove assembly, separate all components.
5. Unscrew ball ball seat ring (TED180108) from ball (TED180118) using assembly tool (½" Allen key).
6. Unscrew loading piston retainers (TED180114) from end sub 'A' (TED180103) using assembly tool (TED180123) and remove die springs.
7. Remove loading pistons (TED180113) from end sub 'A' (TED180103) using 1/4" UNC Screw and remove steel balls.
8. Unscrew end sub 'A' (TED180103) from main housing (TED180102).
9. Remove mandrel (TED180105) from main housing (TED180102).
10. Remove two off ¼" UNC cap screws from seal ring retainer (TED180117) and unscrew retainer from mandrel sealing ring (TED180115) using assembly tool (TED180125).
11. Dis-assemble mandrel sealing ring (TED180115) from mandrel (TED180105). Remove from threaded end of mandrel.
12. Unscrew mandrel choke (TED180116) (if installed) from mandrel (TED180105) using assembly tool (TED180124).
13. Clean all components, remove all seals and inspect all components for damage. Replace where necessary.

    (Address all faults recorded on the operational report.)

"READY FOR RE-ASSEMBLY"

ASSEMBLY PROCEDURES

1. Redress all necessary components with new seals as per general assembly drawing (TED180101).
   NOTE: MSRV Assembly TED180101

2. If required screw the choke (TED180116) into the mandrel (TED180105) using assembly tool (TED180124).
   NOTE: Choke will be of a specific orifice, sized# for the clients proposed maximum flowrate.
   #sized and approved by region support engineer and operations supervisor

3. Slide mandrel sealing ring (TED180115) onto mandrel (TED180105). Screw seal ring retainer (TED180117) into sealing ring and tighten manually with assembly tool (TED180125). Insert two off ¼" UNC cap screws and lightly tighten up.

4. Install mandrel (TED180104) into main housing until it bottoms out.
   NOTE: Sensor ports should be open during installation of mandrel.

5. Screw end sub 'A' (TED180113) onto main housing (TED180102).

6. Insert steel balls die springs, and loading pistons (TED180113) into end sub 'A' (TED180103) then screw in loading piston retainers (TED180114) using assembly tool (TED180123).

7. Slide ball cage halves (TED180109) onto ball seat (TED180108).

8. Screw ball seat ring (TED180112) onto ball (TED180118) using a ½" allen key
   NOTE: MSRV Assembly TED180101 (10K MAWP)
   Thread locking compounds should not be applied to the male right hand thread.

9. Install ball assembly between slots in ball cage (TED180109) ensuring ball is in the closed position.

10. Install ball retainer (TED180110) over ball cage (TED180109).

11. Install ball retaining segments (TED180111) between slots in cage (TED180109) and ball retainer (TED180110).

12. Screw ball seat and cage assembly onto Mandrel (TED180105) using assembly tool (TED180122) with the MSRV main housing in the horizontal position.

13. Slide end cap (TED180106) over end sub `B' (TED180104) and install split ring quarters (TED180107).

14. Screw end assembly onto main housing (TED180102).
   NOTE: While screwing assembly onto housing, keep sub supported outwards to ensure split ring remains in correct position inside end cap.

15. During assembly all thread connections should only be torqued up manually.
   Install 9/16" AESL plugs into three off sensor ports and tighten. Hydraulic testing/function line should be installed into remaining port.

"READY FOR TESTING"

PARTS LIST TED180101 (10K MAWP)

TED180101		GENERAL ASSEMBLY
TED180102		MAIN HOUSING
TED180103		END SUB A
TED180104		END SUB B
TED180105		INNER MANDREL
TED180106		END CAP
TED180107		SPLIT RING
TED180108		BALL SEAT
TED180109		BALL CAGE
TED180110		BALL RETAINER
TED180111		BALL RETAINER SEGMENT
TED180112		BALL SEAT RING
TED180113		LOADING PISTON
TED180114		PISTON RETAINER
TED180115		MANDREL SEALING RING
TED180116		MANDREL CHOKE (OPTIONAL)
TED180117		SEAL RING RETAINER
TED180118		BALL
CX 26 x 32	6 OFF 6 OFF	BALL DIE SPRING LOADING PISTON STEEL BALL
TED180122		BALL CAGE ASSEMBLY TOOL
½" ALLEN KEY		BALL SEAT RING ASSEMBLY TOOL
TED180123		LOADING PISTON RETAINER ASSEMBLY TOOL
TED180124		CHOKE ASSEMBLY TOOL
TED180125		SEAL RING ASSEMBLY TOOL

PARTS LIST TED180101 (10K MAWP) continued

SEALS LIST		
'T' SEALS	**NO REQ**	**ITEM**
427-EXT-1	1 OFF	END SUB-B
427-EXT-2	1 OFF	MANDREL SEALING RING
335-INT-1	1 OFF	BALL SEAT
335-INT-1	1 OFF	MANDREL SEALING RING
335-INT-2	1 OFF	MAIN HOUSING
332-EXT-2	1 OFF	INNER MANDREL

'O' RINGS LIST		
'O' RINGS	**NO REQ**	**ITEM**
222	1 OFF	MANDREL CHOKE
436	1 OFF	MAIN HOUSING
20	6 OFF	LOADING PISTON

PRESSURE & FUNCTIONS TESTS

Connect pressure line from test pump to valve open pressure port.

MSRV - TED180101(10,000 psi MAWP)

The Pressure test rating varies according to the maintenance level performed.

LEVEL 1 - Pressure test is performed at 1.5 times the proposed cold setting pressure.

LEVEL 2 - Pressure test is performed at MAWP of the valve.

LEVEL 3 - Pressure test is performed at 1.5 or 2 times the MAWP of the valve.

(Normally only performed for Certifying i.e. Major Survey)

(0-5000 psi MAWP x 2)
(5000 - 10000 psi MAWP x 1.5)

MAINTENANCE LEVEL 1

- **Hydraulic Chamber Pressure Test**

Operate test pump and apply minimum pressure to function inner mandrel and open valve.

NOTE: Record applied operating pressure to function mandrel.

Pressure up test pump to 1.5 times to proposed setting pressure.

(i.e. Rupture disc burst pressure - 1300 psi +/- 5% - Pressure test-2050 psi.

NOTE: Loading pistons will lift and be flush with the piston retainers as an indication of the mandrel functioning and valve opening.

Bleed off pressure upon completion of test.

Visually inspect through inside of valve to ensure valve is open.

Drift internal diameter of Mandrel to 1.5".

Inspect valve inlet and outlet connections ensuring the sealing faces are clean and free from any damage.

Inspect and assemble seal rings and test hubs to valve connections. Tighten test hubs to manufacturers recommendations.

Fill valve through inlet hub, set up inlet and outlet test manifolds for pressure testing. Ensure pressure testing is monitored at a chart recorder.

- **Internal Body Test**

Operate test pump and pressure up to 1.5 times cold setting pressure

Hold pressure test for 3 minutes

Visually check valve for fluid leakage

Bleed off pressure

Repeat pressure test for 15 minutes

Bleed off pressure once test complete

Connect pressure line to valve closure port and function inner mandrel to close valve

NOTE: Loading pistons will retreat into inner mandrel recess as an indication of the mandrel functioning and valve closing.

DO NOT APPLY MORE THAN 500 PSI HYDRAULIC PRESSURE TO CLOSE - BLEED OFF WHEN CLOSED

- **Closed Ball Valve Pressure Test**

Open relief valve outlet test manifold.

Operate test pump and pressure up to 1.5 times cold setting pressure.

Observe for fluid leakage downstream of seat at outlet manifold.

Hold pressure test for 15 minutes.

Bleed off pressure upon completion of pressure test.

- **Ball Valve Gas Leak Test**

Ensure ball valve is closed and end chamber is filled with water against closed ball.

Operate Nitrogen test pump and pressure against ball and seat to 200 psig. Perform pressure leak test for 10 minutes.

NOTE: The Gas Test should be conducted with the outlet test hub liner submerged in water.
Record leakage rate in BPM (Bubbles per Minute).

Increase Nitrogen pressure to 1,000 psig.
Hold pressure for 2 minutes, perform pressure / leak test for 10 minutes.

Increase Nitrogen pressure to 2,000 psig.
Hold pressure for 2 minutes, perform pressure / leak test for 10 minutes.

Bleed off Nitrogen pressure.
Leave M.S.R.V. in closed position.

- **Seat Leakage Criteria as per API 527**

Leak test pressure 51 to 1,000 psig. Max allowable leak rate 20 BPM.
Leak test pressure 1,001 to 6,000 psig. Max allowable leak rate 40 BPM.

ALL HYDROSTATIC AND GAS TESTING PERFORMED AT AMBIENT TEMPERATURES

MAINTENANCE LEVEL 2

- **Hydraulic Chamber Pressure Test**

Operate test pump and apply minimum pressure to function inner mandrel and open valve.

NOTE: Record applied operating pressure to function mandrel.

Pressure up test pump to MSRV MAWP and hold hydraulic pressure for 15 minutes.

NOTE: Loading pistons will lift and be flush with the piston retainers as an indication of the mandrel functioning and valve opening.

Bleed off pressure upon completion of test.

Visually inspect through inside of valve to ensure valve is open.

Drift internal diameter of Mandrel to 1.5".

Inspect valve inlet and outlet connections ensuring the sealing faces are clean and free from any damage.

Inspect and assemble seal rings and test hubs to valve connections. Tighten test hubs to manufacturers recommendations.

Fill valve through inlet hub, set up inlet and outlet test manifolds for pressure testing. Ensure pressure testing is monitored at a chart recorder.

- **Internal Body Test**

Operate test pump and pressure up to MSRV MAWP

Hold pressure test for 3 minutes

Visually check valve for fluid leakage

Bleed off pressure

Repeat pressure test for 15 minutes

Bleed off pressure once test complete

Connect pressure line to valve closure port and function inner mandrel to close valve

NOTE: Loading pistons will retreat into inner mandrel recess as an indication of the mandrel functioning and valve closing.

DO NOT APPLY MORE THAN 500 PSI HYDRAULIC PRESSURE TO CLOSE - BLEED OFF WHEN CLOSED

- **Closed Ball Valve – Pressure/Function Test**

Open relief valve outlet test manifold.

Operate test pump and pressure up to 1.5 times cold setting pressure.

Observe for fluid leakage downstream of seat at outlet manifold.

Hold pressure test for 15 minutes.

Do not bleed off pressure

Operate test pump, apply pressure through impulse system and open valve with pressure differential

- **Ball Valve Gas Leak Test**

Ensure ball valve is closed and end chamber is filled with water against closed ball.

Operate Nitrogen test pump and pressure against ball and seat to 200 psig. Perform pressure leak test for 10 minutes.

NOTE: The Gas Test should be conducted with the outlet test hub liner submerged in water.
Record leakage rate in BPM (Bubbles per Minute).

Increase Nitrogen pressure to 1,000 psig.
Hold pressure for 2 minutes, perform pressure / leak test for 10 minutes.

Increase Nitrogen pressure to 2,000 psig.
Hold pressure for 2 minutes, perform pressure / leak test for 10 minutes.

Bleed off Nitrogen pressure.
Leave M.S.R.V. in closed position.

- **Seat Leakage Criteria as per API 527**

Leak test pressure 51 to 1,000 psig. Max allowable leak rate 20 BPM.
Leak test pressure 1,001 to 6,000 psig. Max allowable leak rate 40 BPM.

ALL HYDROSTATIC AND GAS TESTING PERFORMED AT AMBIENT TEMPERATURES

ONSHORE – MAINTENANCE LEVEL 3

- **Hydraulic Chamber Pressure Test**

Connect pressure line from test pump to valve open pressure port.

Operate test pump and apply minimum pressure to function inner mandrel and open valve.

NOTE: Record applied operating pressure to function mandrel.

Pressure up test pump to MSRV MAWP and hold hydraulic pressure for 15 minutes.

NOTE: Loading pistons will lift and be flush with the piston retainers as an indication of the mandrel functioning and valve opening.

Visually inspect through inside of valve to ensure valve is open and drift internal diameter of ball is 1.5”

Inspect valve inlet and outlet connections ensuring the sealing faces are clean and free from any damage

Inspect and assemble seal rings and test hubs to valve connections.
Tighten test hubs to manufacturers recommendations.

Fill valve through inlet hub, set up inlet and outlet test manifolds for pressure testing. Ensure pressure testing is monitored at a chart recorder.

- **Internal Body Test**

Operate test pump and pressure up to 1.5 or 2 x MAWP

Hold pressure test for 3 minutes

Visually check valve for fluid leakage

Bleed off pressure

Repeat pressure test for 15 minutes

Bleed off pressure once test complete

Connect pressure line to valve closure port and function inner mandrel to close valve

NOTE: Loading pistons will retreat into inner mandrel recess as an indication of the mandrel functioning and valve closing.

DO NOT APPLY MORE THAN 500 PSI HYDRAULIC PRESSURE TO CLOSE - BLEED OFF WHEN CLOSED

- **Ball Valve Pressure/Function Test**

Operate test pump and pressure up to MSRV MAWP against ball seat.

Observe for fluid leakage downstream of seat at valve outlet manifold.

Hold pressure test for 15 minutes.

Do not bleed off pressure

Operate test pump apply operating pressure through impulse system, open valve with pressure differential.

NOTE: Record applied operating pressure required to function valve.

Close MSRV ball and perform 5 pressure differential cycles at the MAWP

On each occasion hold the MAWP for approximately 1-2 minutes prior to cycle

- **Ball Valve - Gas Leak Test**

Apply pressure through valve closure port and function inner mandrel to close valve
On closure of valve bleed off impulse line pressure to zero
Fill end chamber with water against closed ball valve.

Operate Nitrogen test pump and pressure against ball and seat to 200 psig
Hold on pressure and observe for 2 minutes
Perform pressure/leak test for 10 minutes

NOTE: The Gas Test should be conducted with the outlet test hub liner submerged in water
Record leakage rate in BPM (Bubbles per Minute)

Increase Nitrogen pressure to 1,000 psig
Hold pressure for 2 minutes, perform pressure / leak test for 10 minutes

Increase Nitrogen pressure to 2,000 psig
Hold pressure for 2 minutes, perform pressure / leak test for 10 minutes

Bleed off Nitrogen pressure
Leave M.S.R.V. in closed position

- **Seat Leakage Criteria as per API 527**

Leak test pressure 51 to 1,000 psig	Max allowable leak rate 20 BPM
Leak test pressure 1001 to 6,000 psig	Max allowable leak rate 40 BPM

ALL HYDROSTATIC AND GAS TESTING PERFORMED AT AMBIENT TEMPERATURES

Connect pressure line to valve closure port and function inner mandrel to close valve.

NOTE: Loading pistons will retreat into inner mandrel groove as an indication of the mandrel functioning and valve closing.

DO NOT APPLY MORE THAN 500 PSIG HYDRAULIC PRESSURE TO CLOSE.

The Certifying Authority shall witness all the pressure and function tests performed and upon completion will hand stamp the appropriate valve. A certificate of conformity by the C.A. shall also be issued.

- **Post Operations Function Test**

On return from operations the MSRV shall be activated to verify the operability of the valve

Ensure MSRV is set up in enclosed pressure test bay with all the necessary safety measures taken

Connect pressure test pump onto tee piece manifold
Check rupture disc isolation valve is open and fill manifold against closed MSRV valve with water

Operate test pump and apply necessary pressure to burst rupture disc
(Rupture discs should burst at set pressure +/- 5%)
Once disc ruptures test pump should be continued until MSRV has been fully pumped open
Operating pressure required to move piston should not exceed 200/300 psi

This procedure and any observations shall be logged onto the specific job card

INSTALLATION AND TESTING OF RUPTURE DISC

- **Select rupture disc of desired pressure setting**

Rupture disc must be compatible with safety head design

EXAMPLE FIKE q" Angled rupture disc compatible for installation with Autoclave engineers 9/16" AEHP-q" Angled Safety Head)

- **Selected disc must be approved by third party witness**

NOTE: Disc should be supplied in an individual sealed box. Box should be labelled with disc information. i.e. SETTING, MATERIAL, BATCH NO, etc.

Inspect the rupture disc carefully. If necessary clean the disc using an appropriate solvent.

NOTE: Handle the rupture disc with extreme care. Do not make contact with the disc rupture area. Any scratches or damage could result in leakage or rupture of the disc outside the specified tolerances.

Dis-assemble rupture head gland from lower body
Inspect the seating surface of the holder and ensure clean
If necessary use a solvent or very fine emery cloth
Lubricate the threads of both holder and gland with a lubricant or very light oil

Install the rupture disc gently with the crown of the disc upwards into the lower holder
Position the hold-down ring carefully onto the rupture disc
The angled side of the hold-down ring with the radius on the inner diameter contacts with the disc
The flat side is the outlet side
Locate rupture head gland into the lower body and thread together until the gland mates to the hold-down ring
Tighten the coupling to the manufacturers recommended torque
Torque value stated on certificate of conformity supplied with disc and on tagplate

Install sensor line to valve and selected T-piece as per drawing: (TED180121)
Assemble additional sensor lines to requirements as per drawing (TED180126)

Install rupture head into MSRV assembly
Fill sensor system with glycol through tee blocks against closed isolation valve

Ensure MSRV is closed
Inspect valve inlet connection ensuring the sealing faces are clean and free from any damage
Inspect and assemble seal ring and test hub to valve inlet
Tighten test hub to manufacturers recommendations

Fill test hub with water
Connect pressure test line and set up test manifold for recording at chart recorder

Operate test pump and apply hydraulic pressure to 90% of rupture disc lower burst tolerance
Open disc isolation valve
Hold pressure test for 3 minutes and observe.=
Continue pressure test for a further 10 minutes
Bleed off pressure once complete

EXAMPLE
- Disc nominal burst pressure - 1300 psig
  Tolerance +/- 5% - 1235-1365 psig
  Test pressure - (1100 psig max.)

- Disc nominal burst pressure - 4500 psig
  Tolerance +/- 5% - 4275-4725 psig
  Test pressure - (4000 psig max)

ONSITE TESTING - RUPTURE DISC INSTALLED

The following procedures should be followed onsite/offshore especially when pressure testing with the Rig Cement Unit and the MSRV is installed within the process system. This applies whether the valve sensor is in-line or on a vessel.

Close rupture disc isolation valve prior to performing and pressure testing of the well test system
Ensure applied pressure test is being monitored at a chart recorder/gauge in addition to the cement unit system. This should be installed and observed closer to source and at the choke manifold or separator bypass

Perform pressure test of system as per well test program
The test pressure at the specification break or vessel where the MSRV is installed should not exceed the MAWP of the valve

Perform pressure test against closed MSRV ball and isolation valve
Maintain stabilised pressure test for 15 minutes and bleed off when complete

Pressure up system cautiously to a maximum of 90% of rupture disc lower burst tolerance
Once pressure has stabilised gradually open disc isolation valve and perform test against disc
Hold pressure test for 15 minutes and observe
Bleed off pressure when complete

OPERATIONS WITH EMERGENCY SHUTDOWN SYSTEM

The MSRV linked to the ESD system provides a system with the ability to minimise any hydrocarbon release in the event of an undesirable event. In the event of the MSRV being activated in a live well condition, the valve would open and hydrocarbons would be diverted through the vent lines to overboard. In a conventional situation relief venting would continue until the relief valve closed or the well is isolated. Operation with the ESD is capable simply by the installation of a PSH (High pressure pilot) into one of the MSRV sensing ports. The PSH is then connected into the pilot pneumatic circuit of the ESD system. The system should be set up that in the event of initiation the Wellhead Shutdown Valve is closed (SDV).

- **Installation**

Select PSH of desired setting.
The PSH will have previously been calibrated. This is normally preset at approximately 250 psi but can be preset to specific requirements. It is recommended that the pilot is not set any less than this.

(Onsite PSH should be connected to dead weight tester and functioned to check.)

Remove 1 off 9/16" AESL plug from MSRV sensor port.

Install X-over 9/16" MP RESATO x 1/2" NPTF (ML3-CFT-SG) & the PSH into selected sensor port and tighten.
(A ball valve should be in place between the PSH and port adapter as a contingency.)

Connect pneumatic pilot line of PSH to pneumatic circuit of ESD and ensure pilot ball valve is open. Ensure that all sensor connections are checked tight and all remaining 9/16" AESL sensor ports are plugged off and secure with the specified 9/16" AESL plugs.

The system is now setup and ready for operation.

NOTE: To function the PSH in situation would require activation of the MSRV and this is not recommended as part of the routine pre-test operating procedures.

- **Operation Principle**

In an overpressure situation the system would operate as follows with the MSRV installed between the steam exchanger and separator considering the following detectable conditions.

Conditions
High pressure detected in system downstream of steam exchanger due to blockage, closure of valve etc

The in-line PSH set at approximately 1100/1200 psi fails to respond
Second stage level of protection provided is the MSRV

MSRV rupture disc is burst due to overpressure
The process pressure is then transmitted through the MSRV sensor line into the piston chamber

System Response
The MSRV opens to relieve the overpressure
The PSH detects the pressure within the chamber and is functioned
Pneumatic circuit of ESD is depressurised and consequently vents the hydraulic pressure and initiates a SDV closure

The MSRV and the ESD system will have to be re-initialised after a shutdown has occurred
Close MSRV as detailed in the contingency procedures
Pressure up ESD pneumatic circuitry as per Well test operating procedures

CONTINGENCY PROCEDURES

In an overpressure situation the M.S.R.V. will respond by opening to relieve and control the situation. Once actuated the valve remains open until pressure is applied to the closure port. Only once the well has been isolated and the relief system is depressurised should the valve be closed.

- **Onsite Pressure Testing - Valve Leaks**

Ensure in-line system pressure or vessel is bled to zero

Close rupture disc isolation valve

Disconnect impulse/sensor line from 9/16" AESL sensor port

Isolate MSRV high pressure pilot or remove from MSRV and plug of sensor port
(Otherwise pilot will activate when manually functioning valve)

Install adapter into impulse system/sensor port.
Apply hydraulic pressure and cycle MSRV to the open position
(A maximum of 300 psi will be sufficient to function open the valve)

Observe loading pistons to check position of valve
The loading pistons will lift and be flush with the piston retainers as an indication of the mandrel operating and valve opening

Remove adapter from impulse system/sensor port. Leaving port open.

Apply hydraulic pressure and close MSRV through closure port.

NOTE: The MSRV can be closed by applying hydraulic or pneumatic pressure. However when hydraulically closed the fluid must be drained from the closure chamber.

(Fluid in piston chamber will be displaced out through open sensor port. This is to ensure that the fluid in the operating chamber is not compressed within a closed system when the piston travels from the open to closed position.)

Do not apply more than 500 psi to close MSRV

Bleed off pressure and drain fluid in closure system
Install 1/4" JIC cap onto closure port nipple and tighten
Repeat system or vessel pressure test

Successful Test	Replace impulse/sensor system and continue pressure testing as per procedures
Unsuccessful Test	Proceed with the following:-

Ensure pressure in system or vessel is bled off
Close rupture disc isolation valve
Disconnect impulse system/sensor line as above and open MSRV
Operate test pump and pump slowly through open valve to wash around ball seat and seat ring surfaces
Apply hydraulic pressure and close MSRV through closure port as above
Repeat system or vessel pressure test

Successful Test	Replace impulse/sensor system and continue pressure testing as per procedures
Unsuccessful Test	Remove valve from system and inspect.

WELL OPERATIONS - VALVE ACTIVATED

If activated the valve remains open until reset closed
Only when the well has been secured and the relief system is depressurised should the valve be closed.

Ensure in-line system pressure or vessel is bled to zero

Check rupture disc isolation valve is still open
(This is to ensure that the fluid in the operating chamber is not compressed within a closed system when the inner mandrel and piston travel from open to closed position)

Close MSRV through closure port
Remove 1/4" JIC cap with care, checking for any pressure build up

NOTE: The loading pistons will retreat into the mandrel recess after being level with the piston retainers as an indication of the valve closing. Once the mandrel has travelled to the fully closed position the air pressure within the air chamber will increase and cause the loading pistons to again rise. This does not signify the valve has opened, depressuring of the pressure within the chamber will cause the pistons to retreat and clarify the valve is infact closed.

Bleed off pressure and drain fluid in closure system
Install 1/4" JIC Cap onto closure port nipple and tighten

Close impulse system isolation valve and remove rupture head assembly

Dis-assemble rupture head by removing upper gland from body
Remove spent rupture disc and hold down ring
Inspect inside of rupture head and hold down ring, ensure any debris from previous spent rupture disc is removed

Install replacement rupture disc of desired setting into head as per procedures
Assemble upper gland and body and tighten to recommended torque

Install rupture head assembly into impulse system
Tighten all coupling connections and open rupture head isolation valve

Pressure test through system against closed MSRV and as per rupture disc procedures

"Ready for Operation"

WORK INSTRUCTION

INSPECTION/VERIFICATION OF MULTI SENSOR RELIEF VALVE

WI/AB2068