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Emergency Back Pressure & Unloading Relief Valves Status Indicator System

Operating and Maintenance Instructions



SAFETY INFORMATION



IMPORTANT SAFETY INFORMATION ENCLOSED. READ THIS OPERATING AND MAINTENANCE INSTRUCTIONS MANUAL BEFORE OPERATING PRODUCT.

IT IS THE RESPONSIBILITY OF THE EMPLOYER TO PLACE THE INFORMATION IN THIS MANUAL INTO THE HANDS OF THE OPERATOR. FAILURE TO READ, UNDERSTAND AND FOLLOW THE OPERATING AND MAINTENANCE INSTRUCTIONS MANUAL COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH.

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I. Product Description

Weir SPM is offering a status indicator system for all 3" and 4" Backpressure N2 and Unloading N2 Valves. This optional feature will allow for remote indication and data logging.

The concept is very simple: Anytime the valve piston lifts greater than 0.030", the system will remotely indicate that the valve has opened. When the valve piston has dropped below 0.030", the system will remotely indicate that the valve has closed.

This system offers many advantages including:

- Creating a safer environment for the technician, by allowing remote indication when the valve has opened.
- Allowing an electronic record that the valve sequenced.
- Allowing electronic data logging of the reaction time of the relief valve, relative to the overpressure event.

The feature is optional and is available on all existing models of the Backpressure and Unloading N2 valves.

The system is available in two configurations:

Stand Alone Option - Consists of a control box with LED indicators and a sound alarm which notifies the user of "Open-Closed" status during fracturing operations. A 200 ft data cable will allow remote monitoring.

This option will require minimal investment from the customer, since no interface will be needed with the data van's equipment. However, this option will not allow for electronic data logging of the relief valve's reaction to the overpressure event.

Data Van Interface Option (Recommended) - Requires that the system be directly interfaced into the data van's data-acquisition system which will benefit the user by offering the following features:

- "Open-Closed" status easily visible during fracturing operations.
- Data logging of ERV's status easily visible during overpressure events.
- Reaction time of the relief valve, relative to the overpressure event.

Weir SPM Engineering recommends the use of the data van interface option because it can be used in conjunction with the existing electronic data logging system.

Note:

The relief valve indicator only responds to lifting of the internal piston rod. Due to this, low discharge volumes of fluid will not trigger the indicator. This type of scenario may occur during onsite calibration, in which the fluid pressure is gradually increased until the valve opens. This scenario will not generate enough lift of the piston to trigger the indicator.

Testing has confirmed that a sudden discharge, or overpressure event (minimum 200 psi) must occur to ensure adequate lift of the piston rod.

II. Description of Operation

The "Open-Closed" status is created by the electromagnetic sensor reaction (shown as Detail A in Figure 2) to the vertical motion of the ERV's piston rod.

In the stand alone option the electromagnetic signal is transferred to the control box, which has two LED indicators and sound alarm:

- **Green** - Indicates no motion of the piston (**valve is closed**)
- **Red (with Alarm)** - Motion indicated resulting from overpressure. (Motion detection starts at 0.030" of rod stroke due to hysteresis of the sensor) (**valve is open**)

In the Data Van Interface option the electromagnetic signal is transferred to an open data port in the data-van's data acquisition system. The data van will receive its information from the signal wire from the sensor. Depending on the manufacturer of the data system, integration will have to be determined by the user.

III. Installation

Stand Alone Option

The control box will be connected to the ERV with a 200 ft data cable and placed in the fracturing data van or pump control room. The control box can be powered by any standard 120V AC outlet.

The sensor will be pre-installed and calibrated at the time of the ERV's initial assembly and re-calibrated every time the valve is sent in for maintenance.

Data Van Interface Option

This option's installation varies on the type of data system that is installed in the fracturing data van.

Data cable:

The weather resistant cable provides added protection to harsh environments. The cable will connect between the data van and the sensor which is mounted on the N2 valve.

Specifications of sensor's data cable:

Conductor	4
Gauge	18 AWG
Operating Temp	90C degrees dry/75C wet
Voltage Rating	600 Volts
Cable Weight	57 lbs
Flame Rating	UL-1685

Pin Layout:

Pin 1	Black (+24 volts)
Pin 2	White (Ground)
Pin 3	Red (Not used)
Pin 4	Green (Signal)

Inductive Proximity Sensor:

The inductive proximity sensor activates the status indicator system when the piston raises .030", thus detecting metal. The proximity sensor has an internal oscillator output voltage that is proportional to the distance the metal object is from the sensor's tip.

This is very helpful when interfaced with the data van because the reaction time of the N2 valve can be monitored during fracturing operations.

Figure 1 below shows the proximity sensor and housing. This assembly comes installed and calibrated inside the N2 valve at time of initial assembly or service center scheduled maintenance.

It is important that the sensor and housing not be adjusted unless specified by a Weir SPM representative.

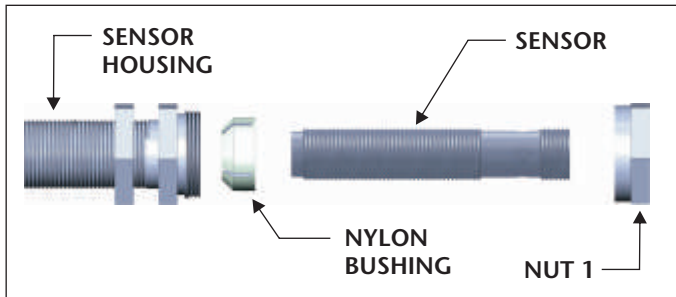


Figure 1: Proximity Sensor & Housing

Specifications of Inductive Proximity Sensor:

Supply Voltage (min)	10 V
Supply Voltage (max)	30 V
Voltage Drop (max)	2 V
Rated Operating Voltage	24 DC V
Load Current Capacity	200 mA
Operating Frequency	50 Hz

Note: The proximity sensor is normally closed.

CAUTION

Contact the specific data-van's DAQ manufacturer for specific wiring and setup instructions.

IV. Maintenance

General:

The Weir SPM 3" or 4" Emergency Back Pressure Relief Valve with "Open-Closed" position indicator is a well designed, dependable component that should provide long term reliable performance for the user. Like any device, however, it requires routine inspection and servicing to guarantee that it is fully functional.

The exposed sensor is covered by a rigid metal housing. However, rough handling or unintentional hammer impacts could affect the performance. It is strongly recommended to avoid unnecessary impact to this component.

Strong vibration may also affect the operation of the sensor, by altering the amount of piston lift required before the indication would occur. This can be negated by periodic verification of the sensor calibration and performance (see Recalibration Procedure below).

The valve is intended to be used as an emergency pressure relief device only, and should not be subjected to continuous fluid flow except in emergency situations. If the valve is subjected to extended flow or abrasive fluids, the valve may not reseal completely once the pressure is relieved.

V. Recalibration Procedure

All Weir SPM ERV's with this monitoring option will be calibrated prior to delivery. This involves adjusting the sensor to indicate a 0.030" lift of the piston rod. Rough handling or strong vibrations may alter this setting and cause the sensor to react unpredictably. Weir SPM recommends that the calibration be verified on a monthly basis under normal use. Contact your nearest Weir SPM Service Center for this calibration service and reference Weir SPM Specification 4S29759.

VI. Vessel Test Procedure

Prior to shipment, product testing procedure 4S12497 requires that each emergency valve pass a one time vessel test at 150% its rated working pressure. Any subsequent tests on used or recertified valves should limit the pressure to 100% of the rated working pressure as required by 4S12497.

Emergency relief valves should always be vessel tested in accordance with product testing procedure 4S12497. **A fully assembled ERV should NEVER be pressure tested with the outlet discharge port blocked.**

Below is an excerpt from 4S12497 regarding the proper vessel testing procedure on used or recertified emergency relief valves:

1. Assemble valve body with required blanking seat, spider, and dummy blanking cap for testing purposes only.
2. Attach valve to testing pump.
3. Fill with water and bleed-off all air from the system prior to testing.
4. Hydrostatically test by pressuring to 100% of product's designed working pressure.
5. Hold pressure for the duration to time specified in 4S12497 and check for leaks. Assembly is considered acceptable if there are no visual indications of leaks, and the pressure drop is within the allowable range specified in 4S12497.
6. Reduce pressure to zero.
7. Please refer to document 4S12497 for thorough test procedure.

NOTE:
Troubleshooting Guide on Page 6.

Recommendation: Purchase a spare spider designated for the sole purpose in testing N2 ERV valves as to prevent damage to the "original spider" that was assembled in your N2 ERV valve.

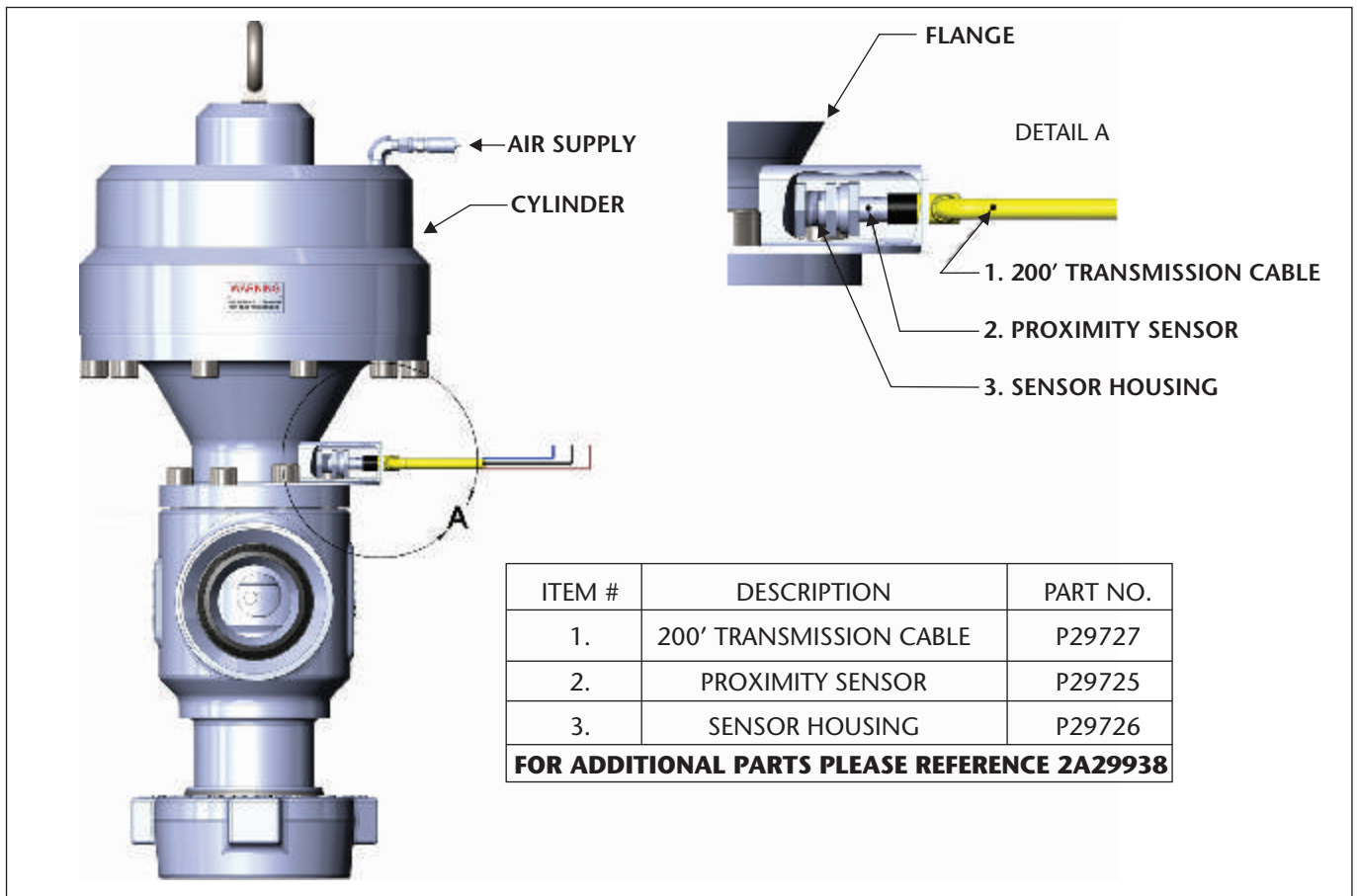


Figure 2: N2 Valve with Status Indicator System

TROUBLESHOOTING GUIDE

Always follow existing company procedure concerning identifying equipment for inspection, and removing equipment from service. The following is intended as a general guide in helping resolve most problems encountered in repairing emergency relief valves. If problems are not covered here please contact Weir SPM for assistance at (817) 246-2461.

SYMPTOM	PROBLEM	SOLUTION
1. The sensor is receiving power (The LED is Green), but does not respond to overpressure events.	<ul style="list-style-type: none"> a) Insufficient discharge volume to lift the valve the required distance. b) Incorrect Calibration 	<ul style="list-style-type: none"> a) With increased discharge volume, the piston of the N2 valve will move the required .030 distance it needs for the sensor to indicate it open. b) Notify Weir SPM Service Center to schedule maintenance and recalibration.
2. The sensor is receiving power (Inactive LED).	<ul style="list-style-type: none"> a) Faulty cable/Connection b) Faulty Sensor 	<ul style="list-style-type: none"> a) Check light on sensor. When it has power it will have a green indication on the tip of the sensor. Have a connectivity test done on the cable by a qualified Electronics Technician. b) Notify Weir SPM Service Center to schedule maintenance and recalibration.
3. The sensor remains "open"(The LED is Orange) after the valve is closed.	<ul style="list-style-type: none"> a) Incorrect Calibration b) Faulty cable/Connection c) Faulty Sensor 	<ul style="list-style-type: none"> a) Notify Weir SPM Service Center to schedule maintenance and recalibration. b) Have a connectivity test done on the cable by a qualified Electronics Technician. c) Notify Weir SPM Service Center to schedule maintenance and recalibration.

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Weir SPM

7601 Wyatt Drive Tel: (817) 246 2461
 Fort Worth Fax (817) 246 6324
 TX 76108
 USA www.weiroilandgas.com

