White Paper
00840-1200-4801, Rev AA
June 2012

DP Flowmeter Installation Best Practice – Geothermal Steam Installation

TOP MOUNT INSTALLATION FOR DP FLOWMETERS IN GEOTHERMAL STEAM SERVICE

This paper discusses mounting a Rosemount 485 Flo-tap Annubar Flowmeter on top of the pipe in geothermal steam applications. This changes the historic recommendations of mounting DP Flowmeters in geothermal steam on the bottom of the pipe.

BACKGROUND

Traditionally DP Flowmeters have been installed on the bottom half of the pipe to prevent the heat of the process from overheating the transmitter and causing a failure. This was possible because wet legs were recommended to ensure that the transmitter was properly insulated from the process. Figure 1 shows the recommendation of the existing steam installation recommendation.

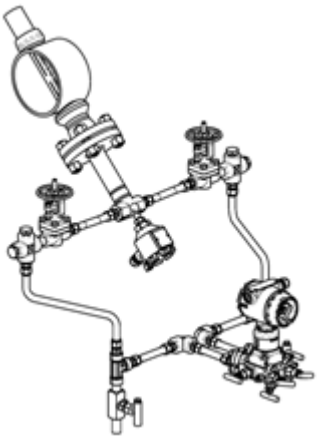

Figure 1: Traditional Steam DP Flowmeter Installation

With this installation, the primary element is installed in the pipe with the instrument connection in the bottom quadrant of the pipe. From the instrument connections the impulse lines were routed downward towards the transmitter, these wet legs isolate the transmitter from the heat of the process steam. The most common problem with this installation is the tendency of the impulse lines, manifolds and the transmitter diaphragms to plug because of deposits from the Geothermal steam. To prevent this, the Annubar flowmeter needed to be removed constantly to be cleaned. This maintenance was very time consuming and costly.

TOP MOUNTING IN GEOTHERMAL STEAM INSTALLATION RECOMMENDATIONS

The new recommendations are intended for a Rosemount 485 Flo-tap Annubar Flowmeter mounted in the vertical position. This vertical position allows condensate that forms in the upper transition of the Annubar sensor to efficiently drain back into the pipe. These recommendations also include a nitrogen purge system that keeps the small internal tubing of the Annubar and the impulse piping free of debris.

APPLICATION EXAMPLES

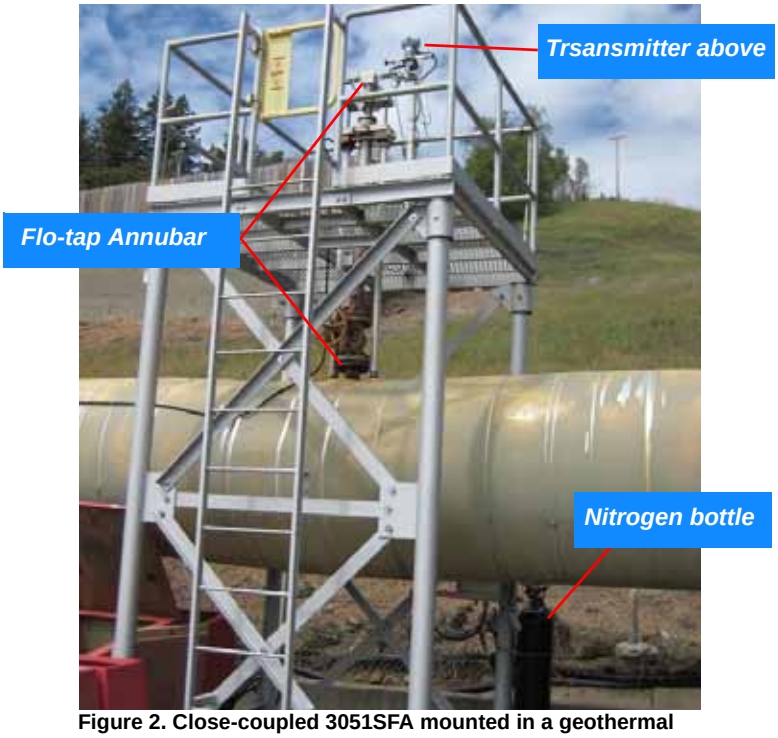

Figure 2. Close-coupled 3051SFA mounted in a geothermal steam application above the pipe. The process temperature in this application was 320 °F (160 °C). Figure 5 shows a thermal image picture of the same installation. This is well below the transmitter's sensor temperature limit of 250 °F (121 °C). This installation is for main steam turbine performance and has been in operation since January 2011 in the Geothermal fields in California.

To keep the geothermal steam condensates out of the smaller passageways located after the instrument valves, an automated back flush with nitrogen is used twice a day. By back flushing for 3 seconds in each high and low passage, as shown in Figure 4, the geothermal steam condenses in much larger areas inside the Annubar sensor reducing down time for cleaning and maintenance. There are three clean out ports (Figure 3) that are easily accessible for simplified maintenance and cleaning.

Nitrogen has an advantage over an air backfill. Air is a combination of roughly 78% nitrogen (N_2), 21% oxygen (O_2) and 1% miscellaneous gases. The nitrogen molecules have a more difficult time escaping through microscopic spaces that can exist throughout the impulse tubing. Nitrogen is a “slow” inactive gas labeled as an inert gas due to its nonreactive nature with many materials. Dissimilarly, Oxygen is a “fast” active gas that reacts with many materials which is called “oxidation.” Additionally nitrogen is a dry gas that doesn't support moisture while oxygen combined with hydrogen makes water (H_2O). The extreme conditions of excessive moisture together with sulfides and chlorides in the steam means that plugging and corrosion can take place at a far faster pace than in traditional steam environments. All of these factors make Nitrogen a great backfill for Geothermal Steam.

Nitrogen is inexpensive, making this a cost-effective solution as well.

With 70 psig Geothermal Steam pressure a back flush with 100 psig Nitrogen is sufficient to keep the corrosive materials out of the small areas.

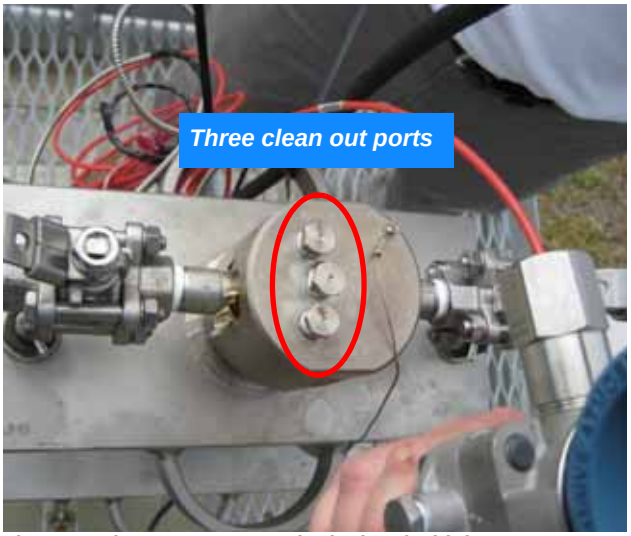

Figure 3. Clean out ports are in the head with large passageways to ensure easy maintenance and cleaning.

Figure 4. Nitrogen purges on high and low sides of the transmitter.

Thermal imaging shows that the Annubar head area is at 175 °F, but the blue areas of the instrument tubing are cool to the touch due to the nitrogen back fill. This obviously protects the transmitter from overheating as well.

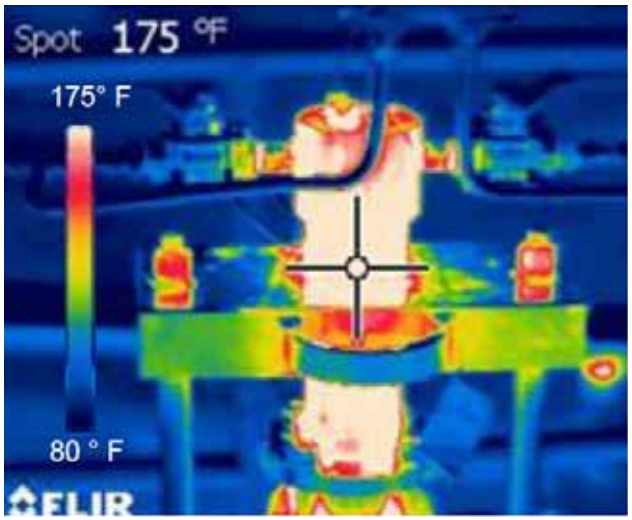

Figure 5. Thermal image photograph of the transmitter mounted on top of the pipe. The transmitter is well within its sensor limits of 250 °F. The temperature indication bar on the left of the thermal image depicts the range of temperatures present. Red indicates temperatures of approximately 110 °F, green indicates values of 100 °F, and dark blue indicates readings of about 80 °F.

SUMMARY AND BEST PRACTICES

Whenever possible, users should utilize a top mount installation for DP flowmeters in geothermal steam service and utilize short impulse lines to attach the transmitter. Top mounting in geothermal steam does not harm the flowmeter or compromise its longevity. Compared with traditional installations below the pipe, top mounting in geothermal steam provides several key benefits:

- Reduced installation costs
- Improved measurement performance
- Higher reliability and lower maintenance costs

Rosemount 3051SFA

White Paper
00840-1200-4801, Rev AA
June 2012

Emerson Process Management
Rosemount Measurement
8200 Market Boulevard
Chanhassen MN 55317 USA
Tel (USA) 1 800 999 9307
Tel (International) +1 952 906 8888
Fax +1 952 906 8889

Emerson Process Management
Flow
Neonstraat 1
6718 WX Ede
The Netherlands
T +31 (0)318 495555
F +31(0) 318 495556

Emerson FZE
P.O. Box 17033
Jebel Ali Free Zone
Dubai UAE
Tel +971 4 811 8100
Fax +971 4 886 5465

Emerson Process Management Asia Pacific
Pte Ltd
1 Pandan Crescent
Singapore 128461
Tel +65 6777 8211
Fax +65 6777 0947
Service Support Hotline : +65 6770 8711
Email : Enquiries@AP.EmersonProcess.com

00840-1200-4801 Rev AA, 6/12

EMERSON
Process Management