HBS Bulletin

HARDBANDING SOLUTIONS by POSTLE INDUSTRIES

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In past bulletins we have talked about the importance of temperature management when hardbanding. Proper pre-heat temperatures and controlled post-weld cooling process are critical to the success of a completed weld. We recently completed a study of pre-heating and post-weld cooling in a cold weather environment. We also measured the effectiveness of our Postalloy® HB Insulators. In this study we also learned how quickly a weld can cool without any type of insulating measures.

Test Environment

This test was conducted in North Dakota, the ambient temperature was 36°F (2°C) with a 20 mph wind and light rain. All temperatures were measured on pipe body and tool joint and were 38°F (3°C) prior to pre-heat.

The Application

This particular application was to apply three 1" bands with Duraband on 5" (127mm) drill pipe with a 6½" (165mm) OD tool joints. Pre-heat was performed using a standard cylindrical type propane heater. The tool joint was pre-heated to 400°F (204°C) and heated consistently by rolling the pipe frequently during the pre-heating process. Pipe was chucked in the hardbanding unit and final temp check made which was 375°F (190°C) on the OD of hardband area. Duraband was applied in reverse polarity with 31 volts and 365 amps with 1-inch stick out at a rotation speed of 142 seconds. After hardbanding application the pipe was removed and interpass temp checked at 1" (25mm) away from last completed band.

The Test

Two Digital pyrometers were used comparing results to verify calibration. All surfaces were clean prior to measurement. Temp measurements were taken on the OD as well as the ID to insure soaked heat reading. Temperature was recorded at 625°F (330°C). The ID temp under HB area was also recorded for reference at 800°F (427°C). The connections were immediately covered with a Postalloy HB Insulator. Thread protectors were inserted on the pin end of pipe to insure no wind traveled through pipe.

The following measurements were made at intervals to record temps on Interpass location on OD as well as ID location under HB.

Time After Application	Interpass Temp on OD	Interpass Temp ID
Initial Reading	625°F (330°C)	812°F (433°C)
15 minutes	560°F (293°C)	610°F (321°C)
40 minutes	510°F (266°C)	545°F (285°C)
50 minutes	498°F (259°C)	520°F (271°C)
60 minutes	489°F (254°C)	510°F (266°C)
90 minutes	452°F (233°C)	469°F (243°C)
120 minutes	397°F (203°C)	409°F (209°C)
180 minutes	309°F (154°C)	314°F (157°C)

Observations

When compared to alternate slow cooling methods, we observed that an insulated bag type of cooling is much more effective especially in cold conditions and when the slow cooling device (Postle HB Insulator, cooling can, etc) is removed, even for a few minutes, the OD temp can drop 60-70°F. The cooling device must remain in place.

The ID temperature is much more reliable for temp measurement for pre-heat as it is soaked heat as well as monitoring heat on slow cool as it is the temp surrounding the heat affected zone.

You must cover the pipe immediately after welding. Periodically a temperature measurement should be taken to determine if the proper interpass temperature is being achieved, but that interpass temperature should be taken quickly. Filling voids, if necessary, must be done immediately while the pipe is still chucked in the hardbanding unit. This will minimize the effect of delaying the slow cooling process.

Summary

The primary reason for preheating a joint is to know that when the welding procedure is completed, the interpass temperature of the joint will be between 700° to 800°F (371° to 427°C). This is due to the carbon content of 4137 (or similar) steel. This is the best temperature to begin the slow cooling process for proper conditioning of the base metal (tool joint). The method of slow cooling can have a dramatic affect on the process. Cooling cans have been a standard for hardbanding slow cooling for a long time, but insulating devices like the Postalloy HB Insulators are much more effective especially in cold environments. Call Postle Industries or your Tech Center for more information on Postalloy HB Insulators.