PROHEAT 35 Induction Heating Application Photos for PREHEAT and PWHT

Miller

PREHEAT APPLICATIONS and VARIOUS COIL CONFIGURATIONS FOR PREHEAT

Transmission Pipeline Construction - Preheat

Transmission pipeline construction projects usually require preheat for welding. These 36” diameter pipe ends are being heated with the originally designed induction heating blankets. This led to the addition of Kevlar sleeves for protection. Workers mark the ID with a temperature indicator and give a “thumbs up” to the tractor operator. He then shuts the induction power sources down via a remote on/off control.

ProHeat in Severe Climates

PROHEAT power sources operate reliably throughout the year on remote pipeline construction projects around the world in all climates. The frigid winters of Siberia and Northern Canada can be well below -40C while desert conditions in the Middle East often see temperatures in excess of 50C.

Transmission Pipeline

A large diameter gas transmission pipeline requires minimum interpass preheat maintenance while welding. In this application, the thermocouples are located underneath the blanket and the PROHEAT is programmed for a temperature above the minimum requirement to ensure the weld zone reaches the desired temperature.

Transmission Pipeline Tie-in

Tie-in welds requiring preheat are common during new pipeline construction. They typically take place in the trench at road bore and river crossing locations. A 75 ft. (24 m) output cable is now available to reach the pipe far from the trench. The external line-up clamp shown to the left of one of the coils was in position for the tack welds, and then moved off to the side to complete the weld.

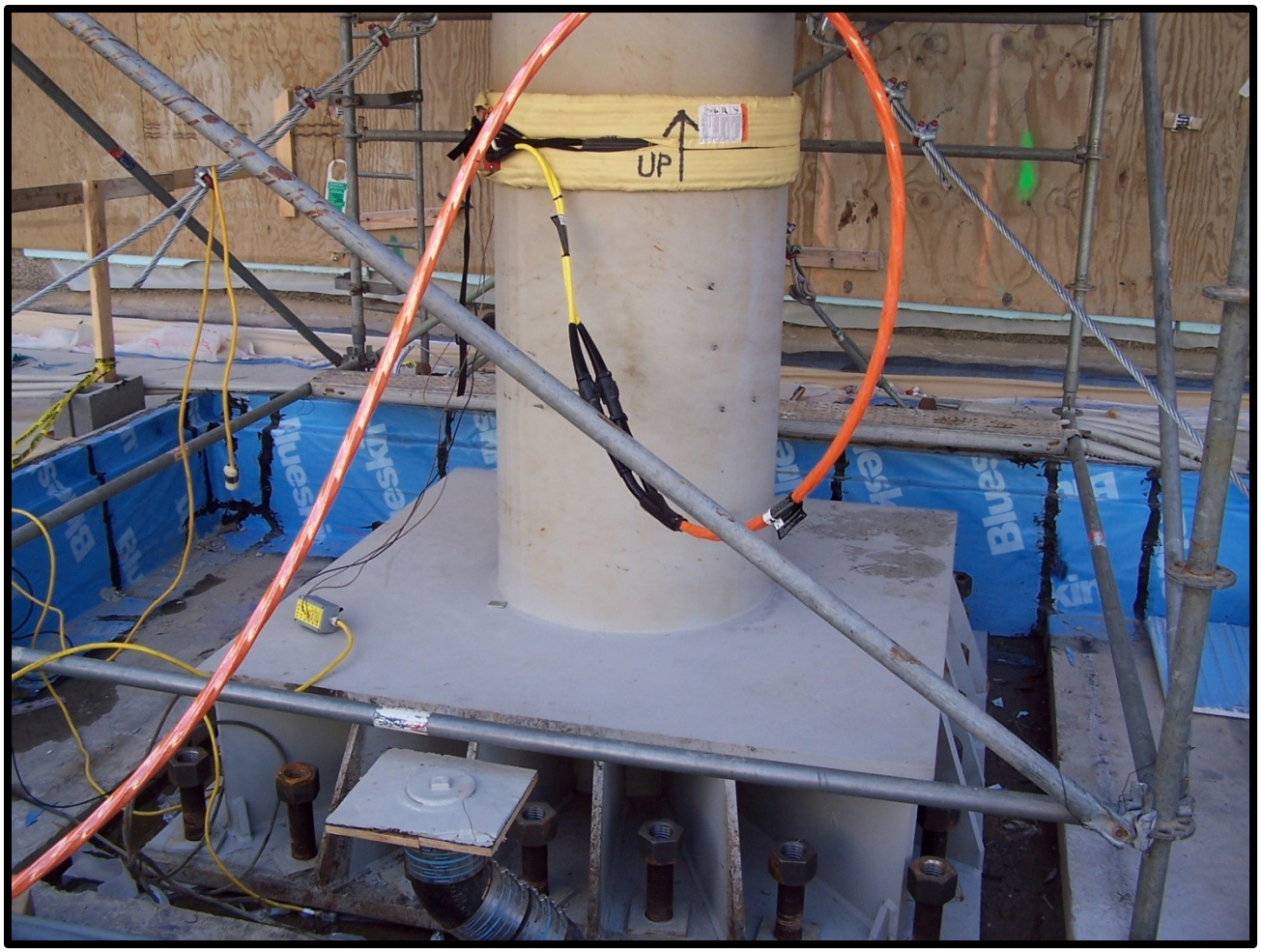
Plate Assembly Preheat – Bottom Side

Thick, structural plates often require preheat prior to welding. In this application, the steel plate is being preheated from the opposite side of the plate. A long wood board is used to press the induction heating blanket against the steel. Control thermocouples are always positioned on the coil side of the steel as shown (TC probe on the right).

Plate Assembly Preheat – Top Side

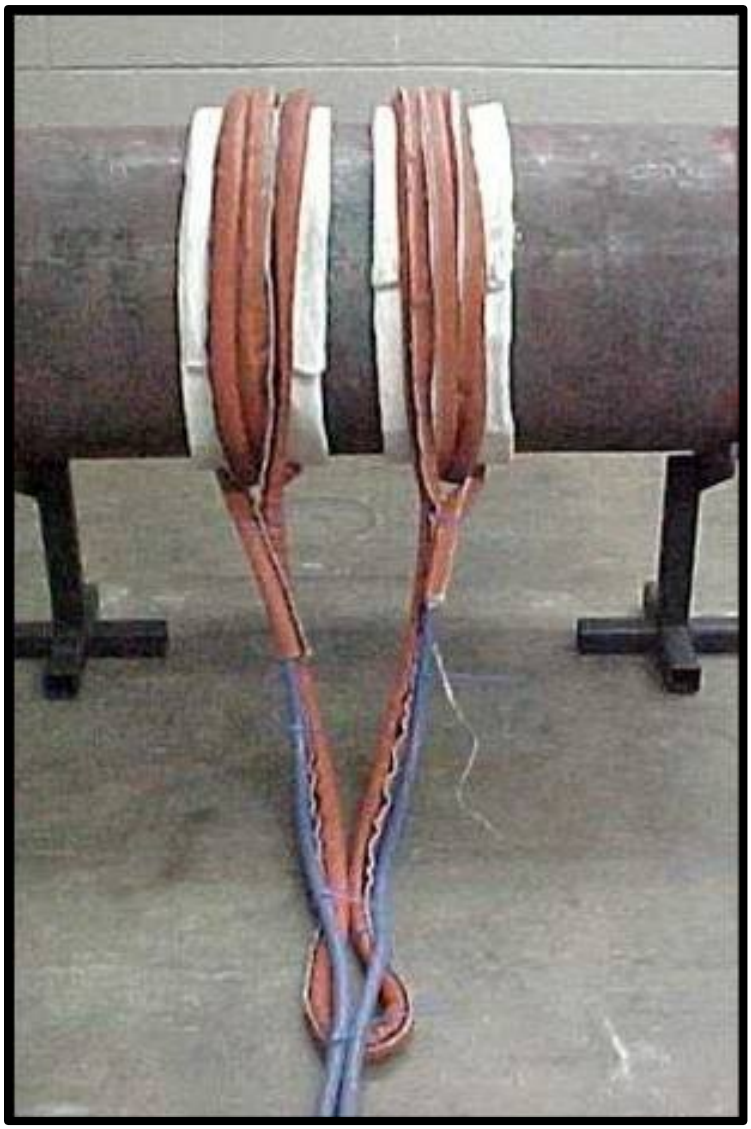
Another view of the thick plate preheat application showing the blanket underneath the steel and secured by the wood board. This is a sub-arc (SAW) welding application with run-off tabs tacked to each end of the long plates. Two ProHeats were used in this application, maintaining preheat temperatures continuously for 12 hours.

Structural Pipe Preheat



Heavy wall pipe is sometimes used as structural support beams for overhead structures. These might include offshore platforms, building pilings, or roofs, as in this case. Many welding procedures for these require preheat to minimize risks of hydrogen cracking in the weld. Note that the blanket stays in position on a vertical pipe.

Pipe Preheat Coil Set Up



Water cooled induction heating cables are often used for preheat applications. This photo shows the proper coil configuration to heat each side of a weld zone with one cable (with protective cover).

Pipe Fabrication Preheat

Many fabrication shops require preheat for power plant and process pipe subassembly welding. One coil is used to heat both sides of the weld joint, maintaining preheat throughout the entire weld cycle. The coils themselves do not get hot while energized. Note the new silver preheat covers for the heating cables.

Valve Casting Preheat

This valve body repair application photo illustrates the ability of the coil to be configured in many shapes to match the geometry of the part.

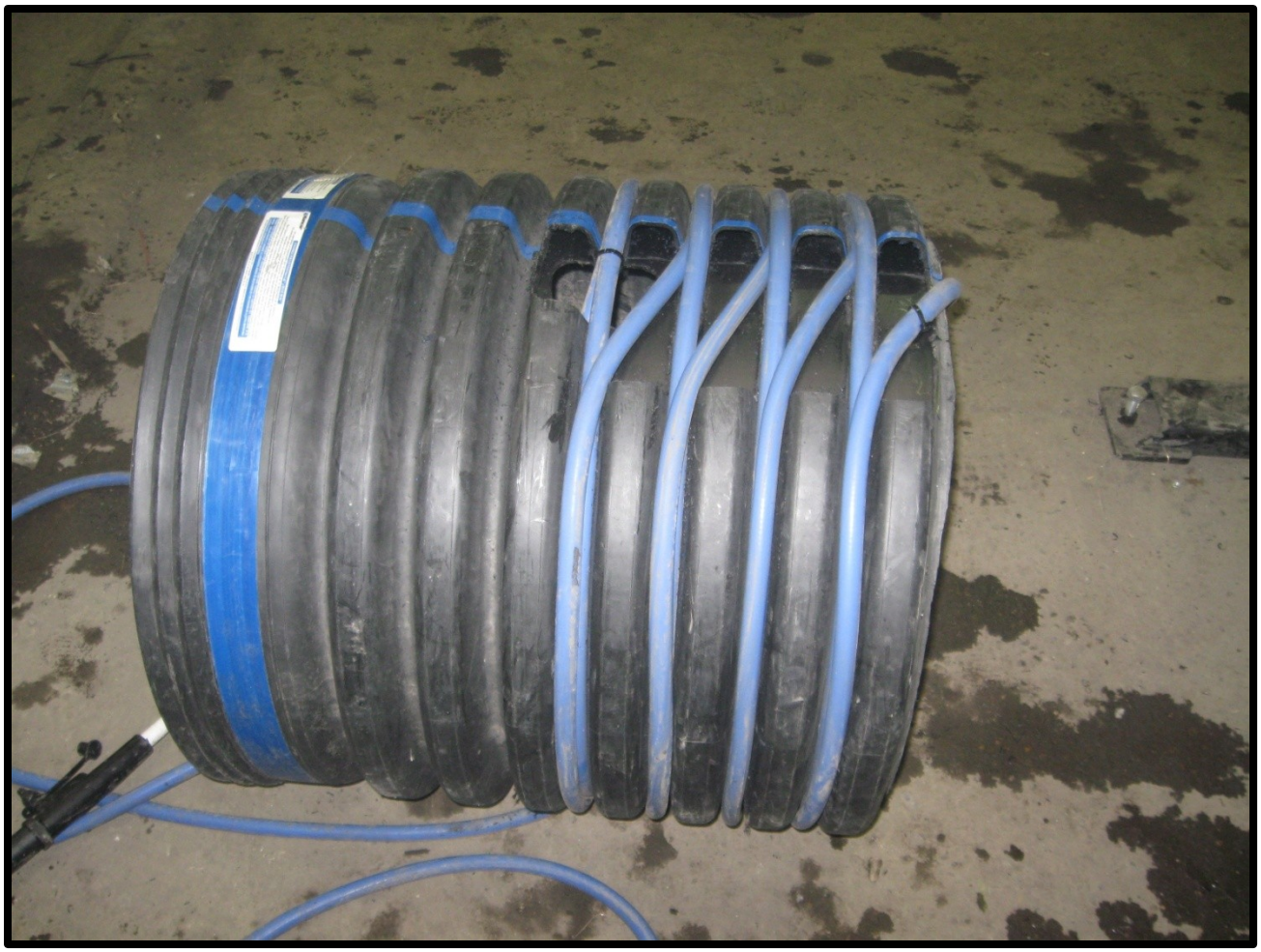
Coil for Internal Angled Branch

Nonmetallic fixtures are commonly used to secure the flexible induction heating coil to heat various geometries. This coil layout is intended to heat the ID of a pipe segment being welded to a large tank at a skewed angle as shown in the next photo.

Assembly Layout for Angled Coil

The coil fixture in the previous picture will slide into the ID of the angled branch connection to preheat the pipe from the inside out. The fixture has a diameter less than the ID of the pipe segment to allow room for preheat insulation to protect the coil.

Double Stack Coil Fixture



This coil fixture uses a corrugated plastic pipe to help guide and secure a double stack coil used to heat the ID of a heavy wall pipe/flange assembly shown in the next photo. This configuration magnetically coupled with the steel to obtain the full 35 KW output from the PROHEAT.

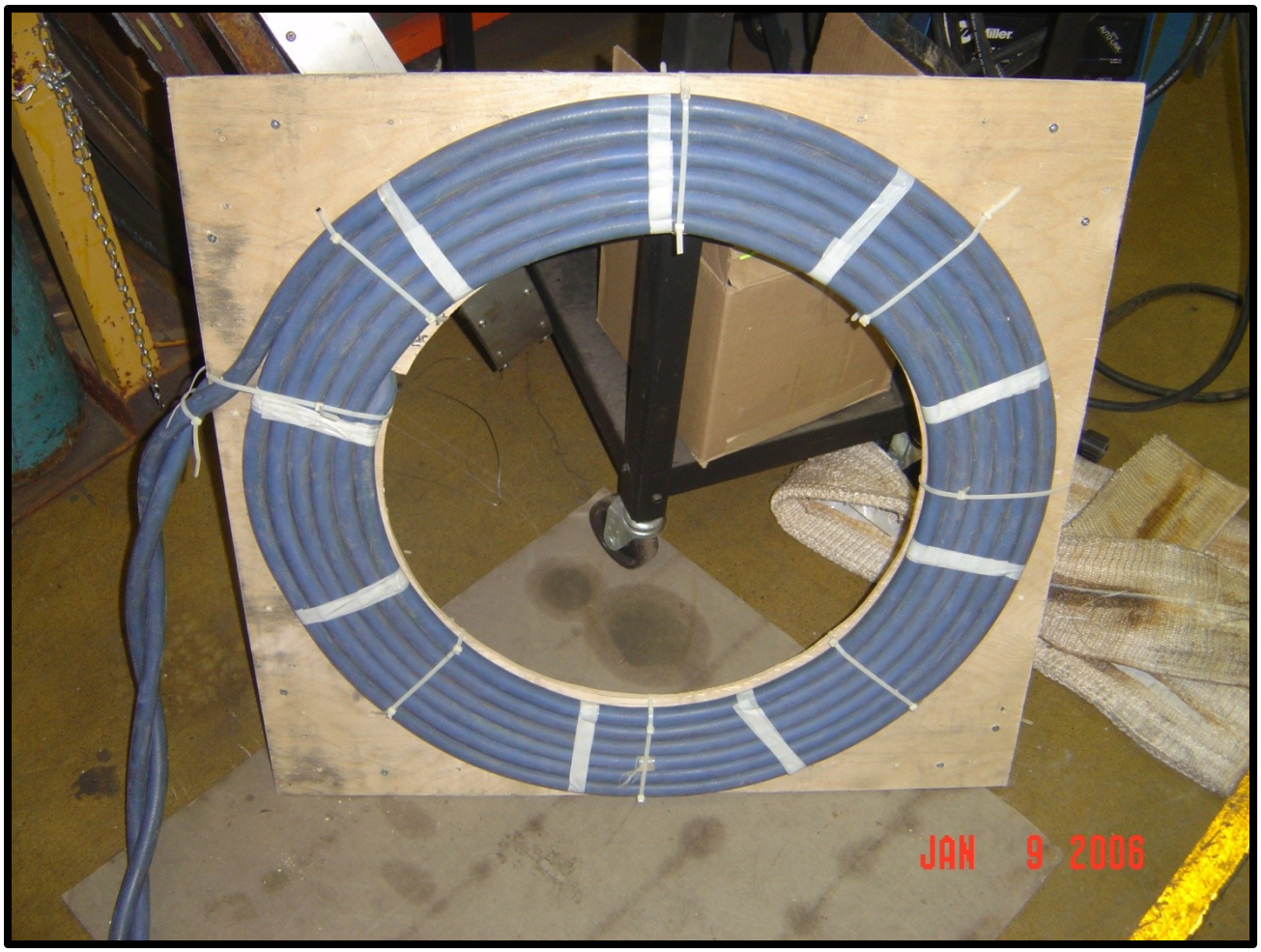
Double Stack Coil – Pipe ID

The coil fixture is position on the ID of the pipe/flange assembly, providing preheat from the inside out and unobstructed weld accessibility on the OD. Spacers are used to maintain a uniform air gap between the coil and the ID. Similar coil fixtures are often secured to a stationary stand to permit the part to rotate while welding.

Weldolet Preheat

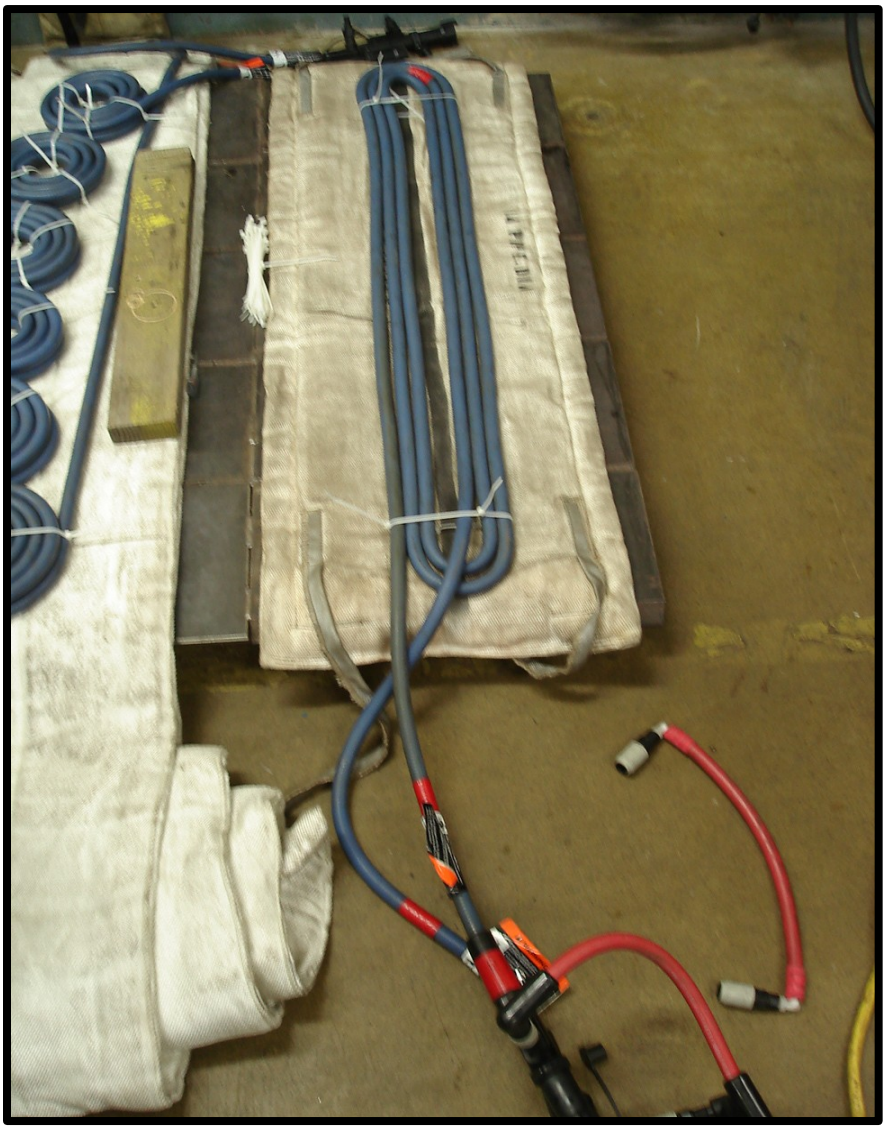
Coil flexibility is important to be able to accommodate various geometries. In this application, a short pipe segment is being welded to a larger diameter pipe. One heating coil is used to form the saddle coil on the large pipe as well as the spiral coil on the short pipe, providing clearance for the welder.

ProHeat 35 Fixture for Flat Plate



This round, but flat “pancake” coil was created for a preheat application where a thin-wall pipe was being welded to a thick, circular base plate.

Elongated Coil and Elongated Pancake Configuration

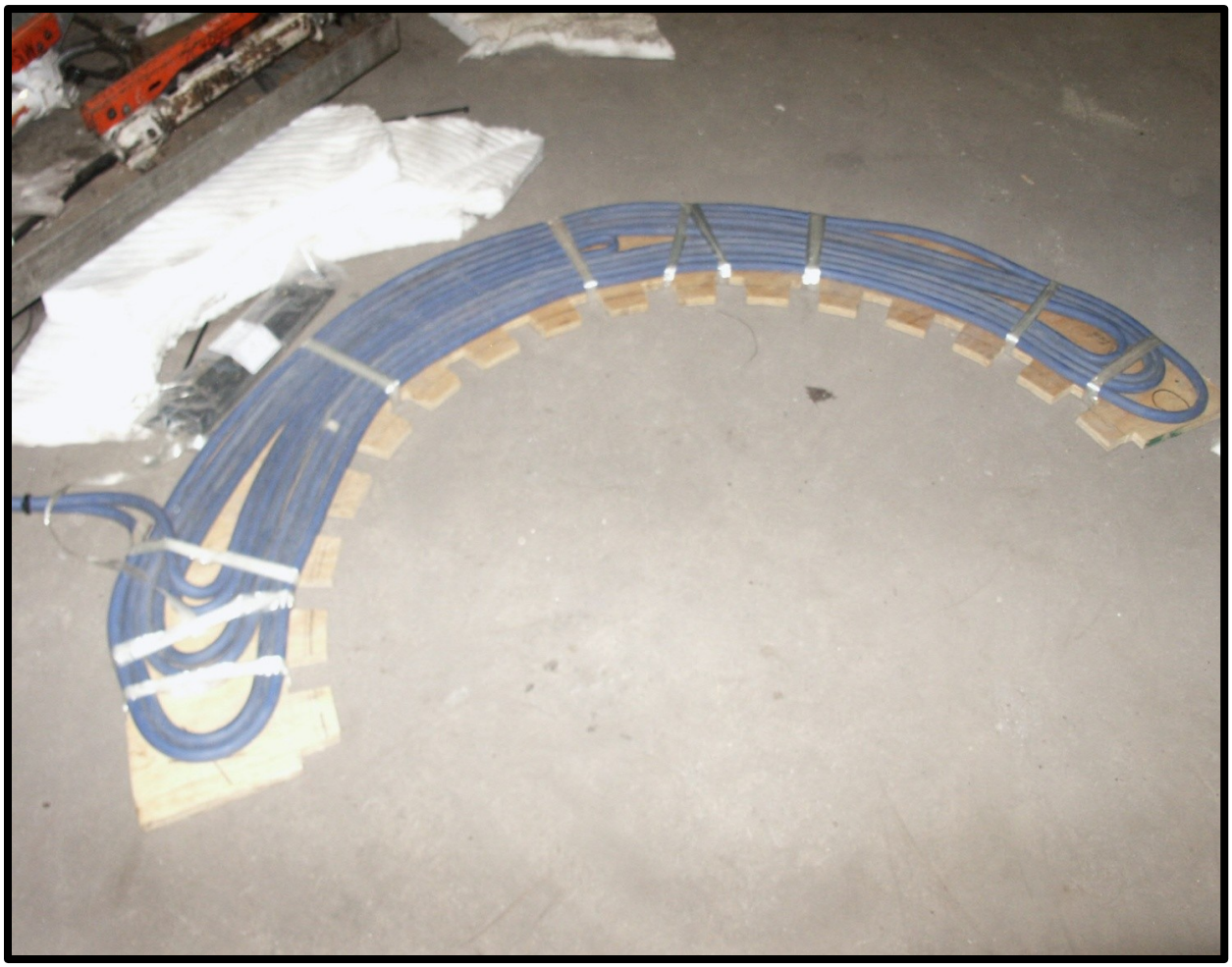


Many coil types can be created with the liquid-cooled heating coils.

90 Degree Flat Plate Coil

An elongated pancake coil can be used to heat weld seams in flat plate or positioned at an angle as shown here to preheat two I-Beams that are perpendicular to each other. Plywood fixtures are often used for low temperature preheat applications. If you look closely, you will see ½" thick preheat insulation separating the plywood fixture from the steel.

Induction Special Coil



Coils are often configured in creative ways to match the geometry of the part being heated. Since preheat temperature requirements are often less than 400 F (204 C), nonmetallic fixtures such as plywood can be used to secure the coils.

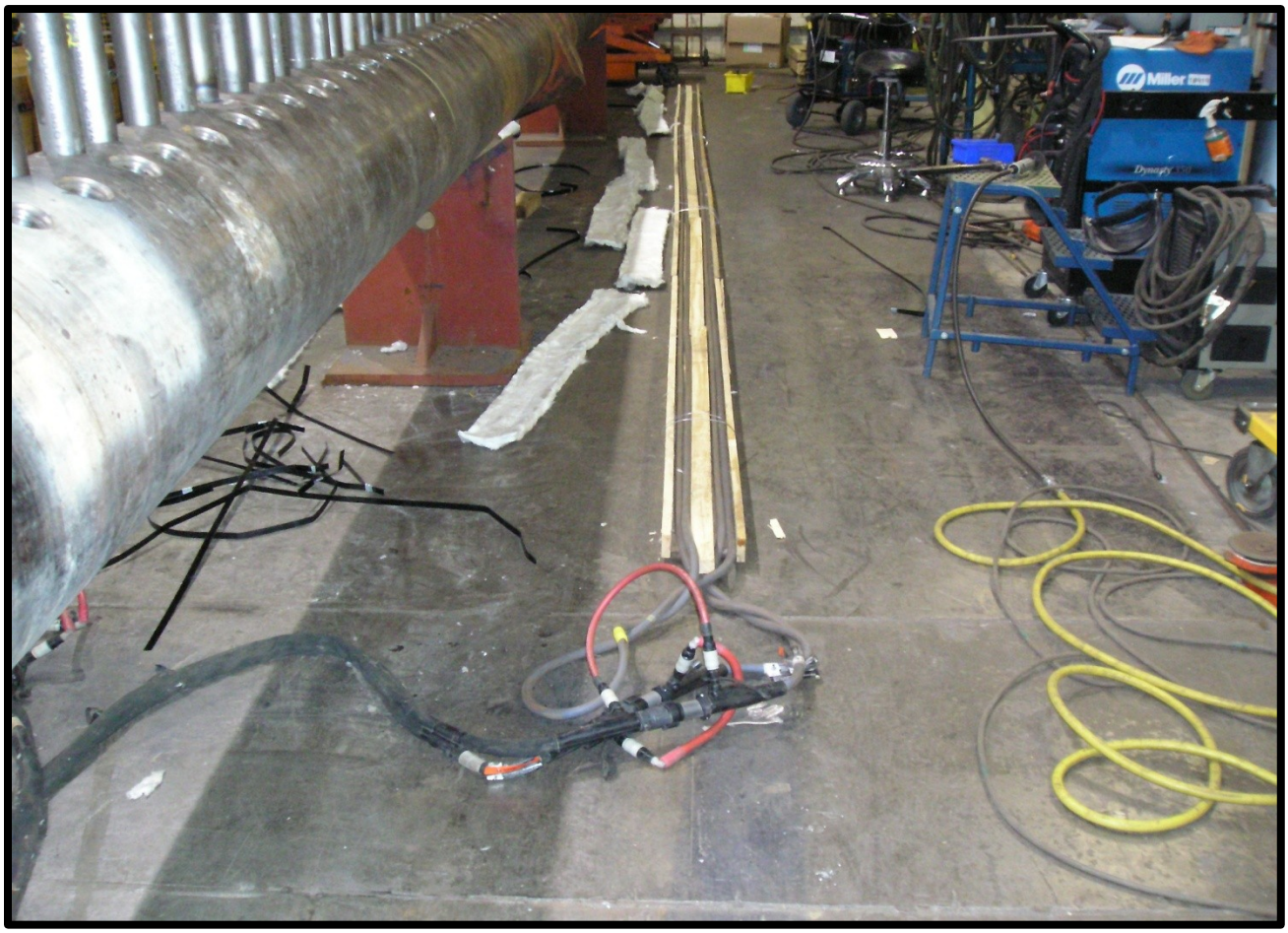
Custom Coil – Curved Flat Plate

This is the installation of the coil shown in the previous application photo which was sent by the customer stating it is NOT WORKING WELL. In this application, the customer decided to use thick KAOWOOL instead of our woven silica preheat insulation. This coil was about 3” (76 mm) away from the steel, which reduced the magnetic coupling and the KW into the steel.

Offshore Jack-up Riser

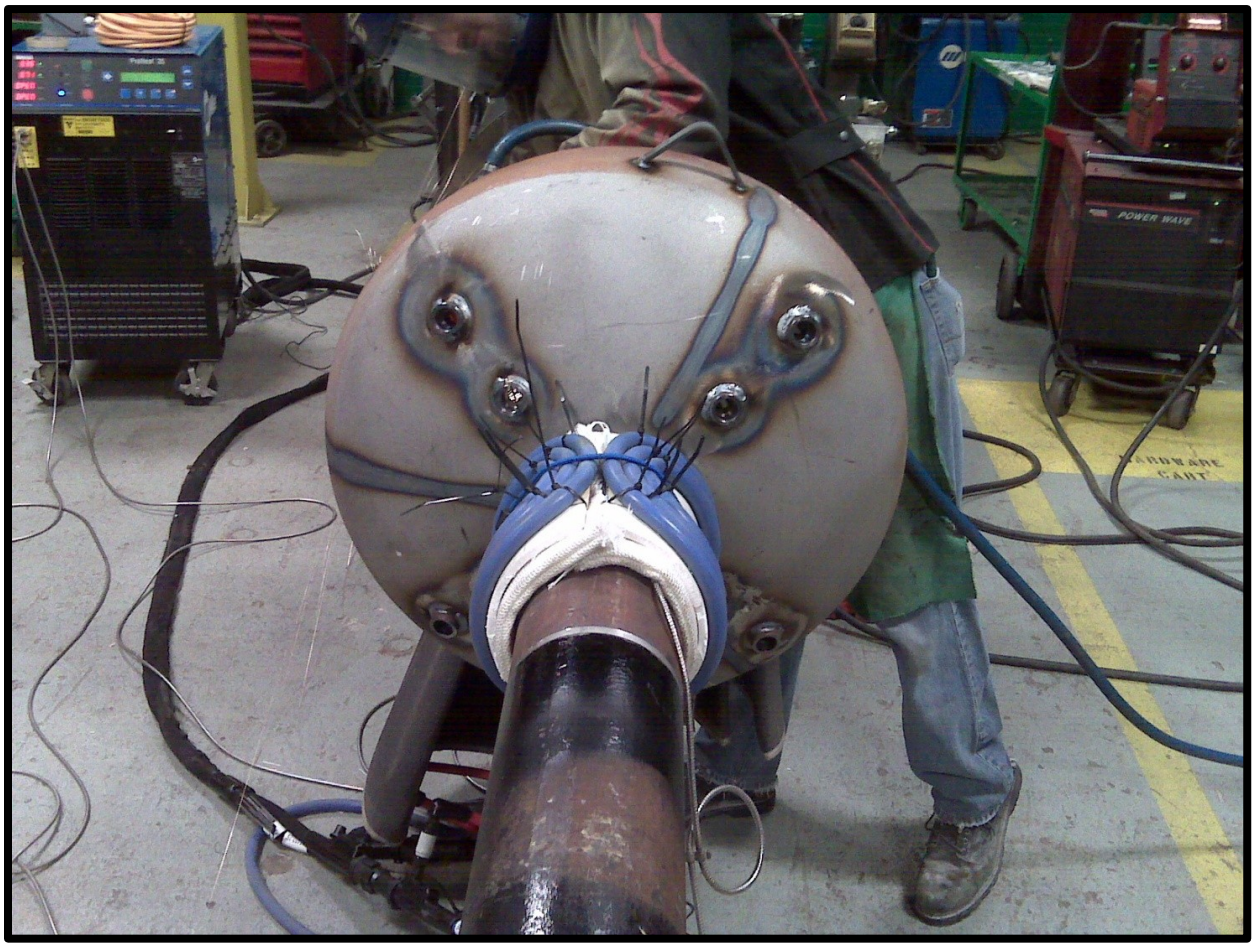
In this application, the heavy teeth of a jack-up riser require preheat prior to welding to a structural pipe. The PROHEAT's liquid-cooled coils can easily follow the contour of many complex geometries.

Elongated Preheat Coil



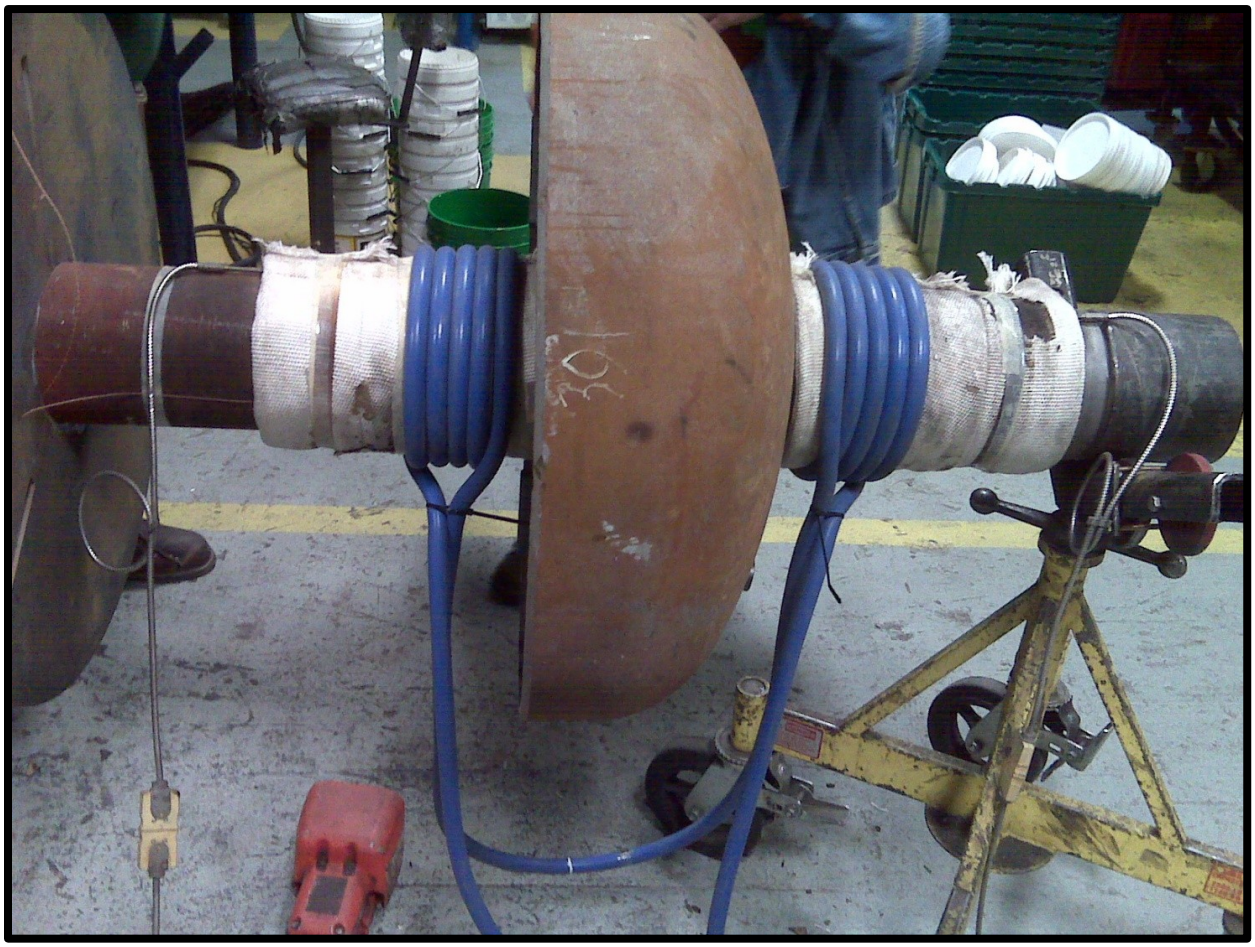
The 140 ft. (43 m) liquid-cooled heating coil is ideal for creating an elongated coil to preheat long parts such as this header, or long seam welds common when welding plate together. Once again, strongly promote the use of the tested, woven silica insulation, not KAOWOOL or fiberglass insulation that customers try to use to save money. Other untested materials may not have the insulating properties needed to protect the heating cable.

Elongated Pancake Coil Around Pipe



Instead of a spiral coil around the pipe, two elongated pancake coils were used to consider the possibility of using a clam shell fixture to easily install and remove the coil. Ease of use often dictates what kind of coil to try.

Two Shaft Locations Need Preheat



A large diameter cylinder end cap requires preheat at both weld locations on a steel shaft. This is often done by forming two coils with one heating cable, using part of the cable to bridge over to the opposite side.

Casting Perimeter Heating Coil

This is a steel casting requiring preheat along its perimeter prior to welding.

Coil Layout – Without Insulation

Here, a large spindle used for grinding tree trunks and limbs requires preheat to weld on the “teeth”. The customer is considering the coil layout to evenly heat the spindle before adding preheat insulation.

Hot Tap – Refinery Piping

A split tee is being welded to a flowing refinery pipe (hot tap). Localized preheat is easily done with induction heating to maintain interpass temperatures while welding. A wood fixture is being used to hold the coil along the seam weld joining the two sections.

Hot Tap – Refinery Piping

Circumferential welds are also required on each end of the split tee to secure it to the parent pipe.

34 Inch Diameter Oil Line – Sleeve & Pipe Coils

Reinforcement sleeves are commonly added to older, flowing pipelines. In this application two power sources are used to independently heat and control temperature on the parent pipe and the sleeve prior to welding.

Double Turn Coil for Flat Plate

Using one heating coil, a double turn “pancake” style coil is being laid out for preheat testing in front of a moving subarc torch. The PROHEAT is capable of heating 1” (25 mm) thick steel to over 250 F (121 C) preheat temperatures while moving at typical weld travel speeds.

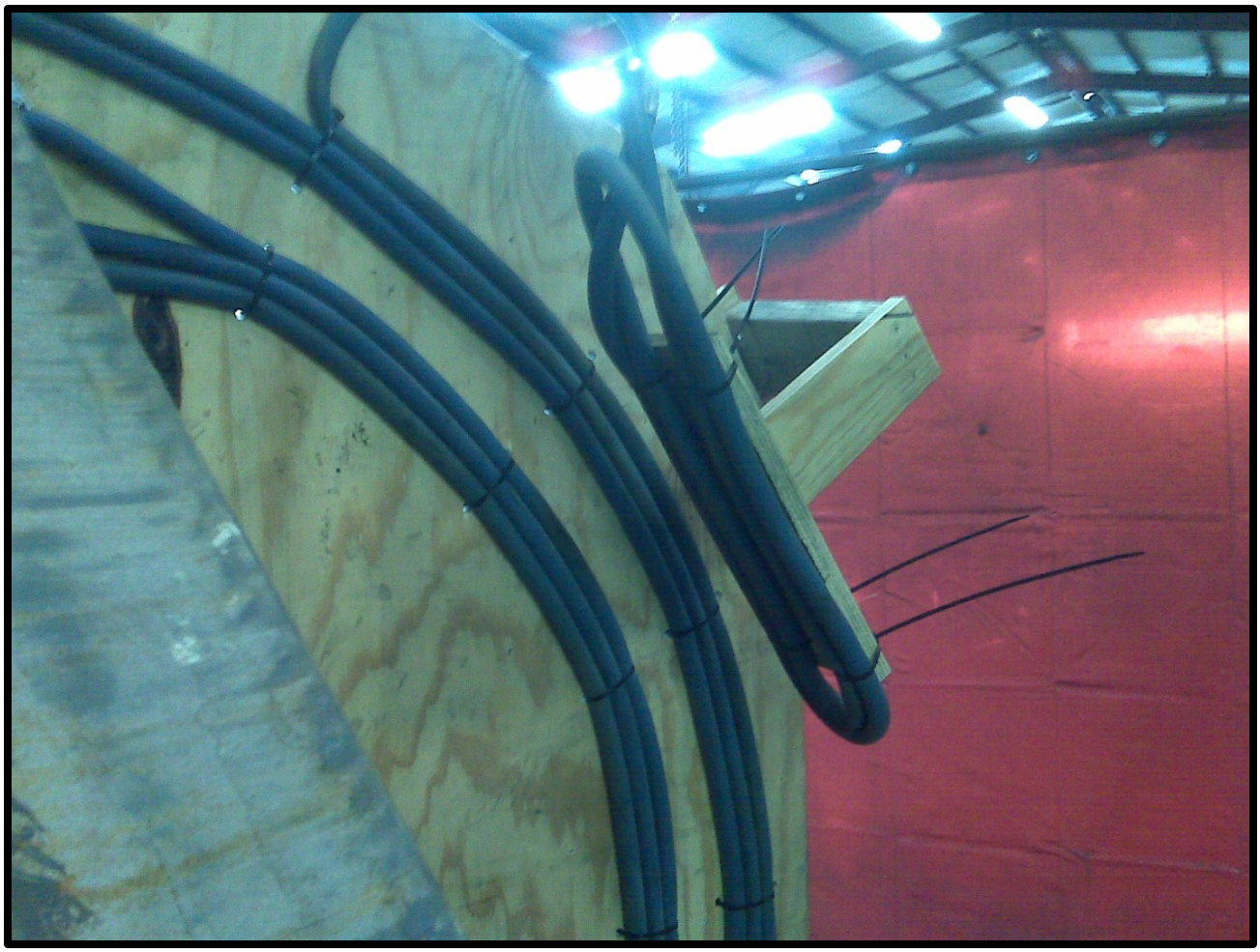
4-Turn Pancake

This is another example of a test coil for flat plate or heating “on-the-fly”. The coil is flexible enough to be able to wind into tight circles for concentrated zonal heating.

Turning Baseplate Coil Fixture

Thick base plates welded to formed steel tubes to fabricate steel poles and towers often require preheat. In this application, the baseplate is heated from the back side while the entire assembly is rotated. Coils are often customized for special applications.

Turning Base Plate Assembly



In this view, part of the heating cable is used to make a small coil to heat a portion of the formed tube. Since the tube steel thickness is less than the baseplate thickness, a smaller coil is formed to prevent overheating.

Turning Base Plate Assembly

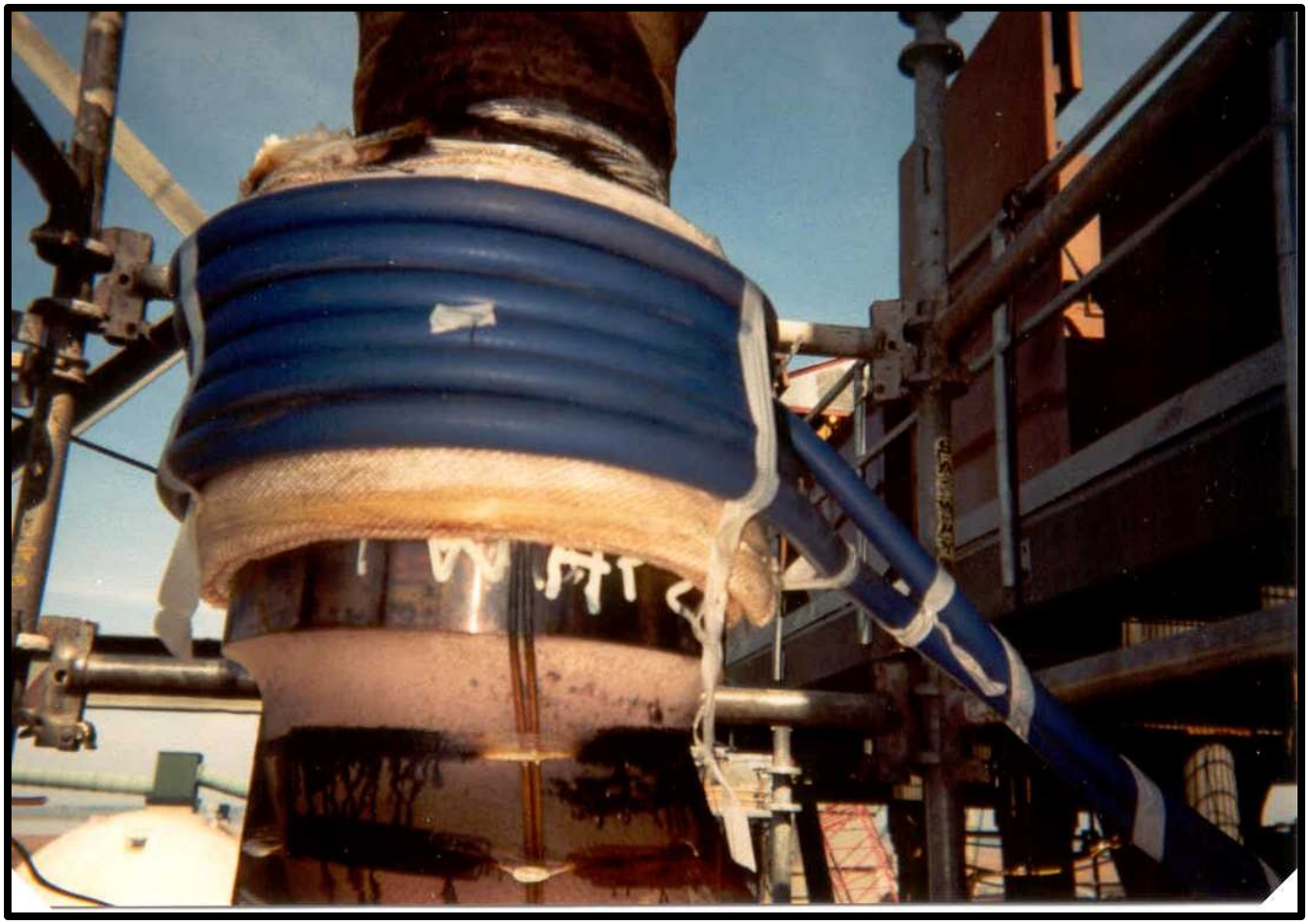
In this view, the coil fixture is in position so that the plate/tube assembly can freely rotate. The steel heats up as it moves past the coils, which are in a fixed position.

Movable Coil Fixture

Coils have been successfully used in fixtures designed to move in front of a sub-arc welding torch to enable heating “on-the-fly”. In this application, the PROHEAT does not use thermocouples for temperature feedback and control. Instead, the PROHEAT is used in MANUAL mode to control power to the coils in front of the weld. This fixture is a heat-resistant, fiberglass channel using carbon-reinforced rods for the axles. The wheels are made out of nonmagnetic stainless steel.

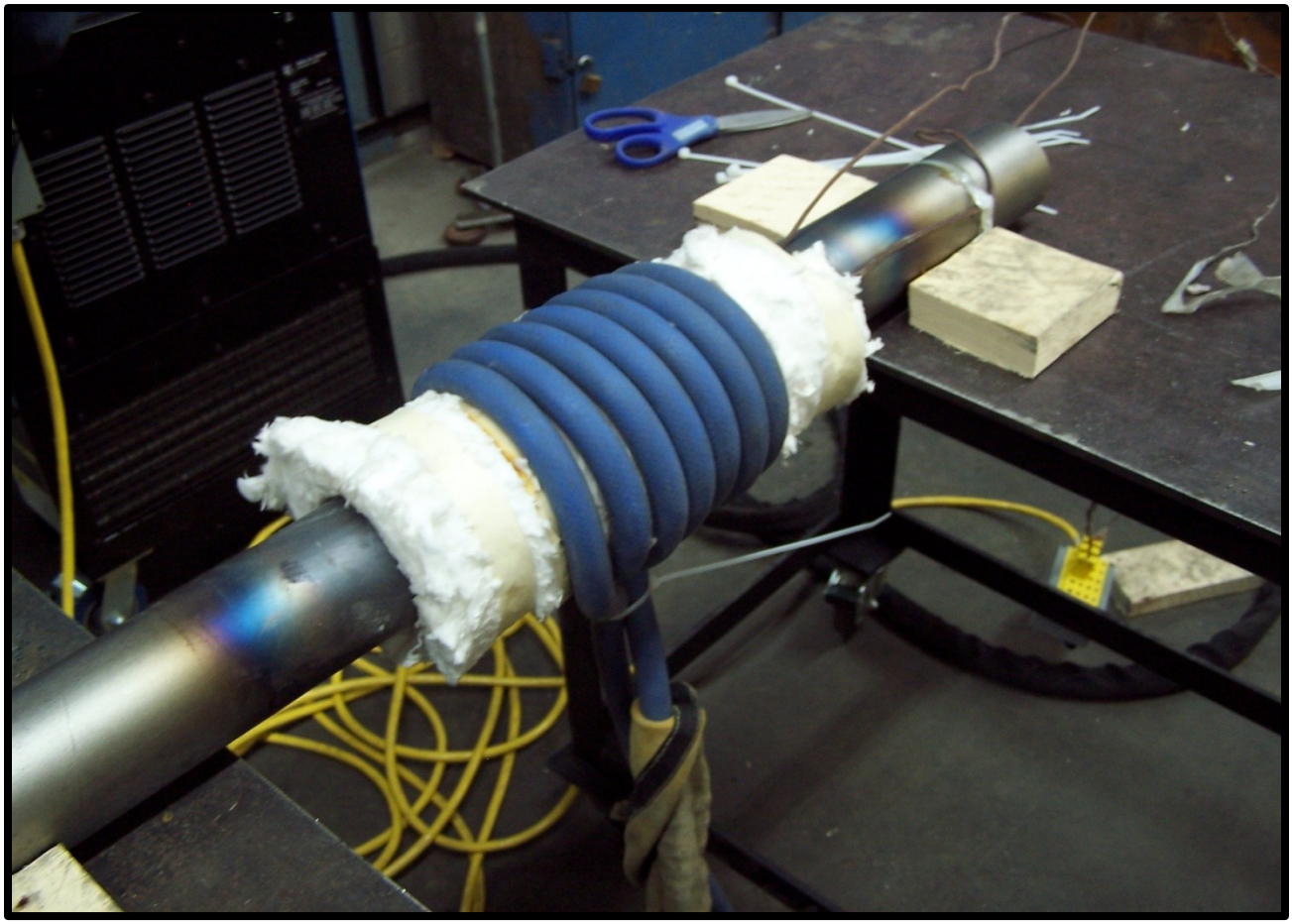
PWHT APPLICATIONS and VARIOUS COIL CONFIGURATIONS FOR PWHT

Power Plant Pipe – PWHT On-Site



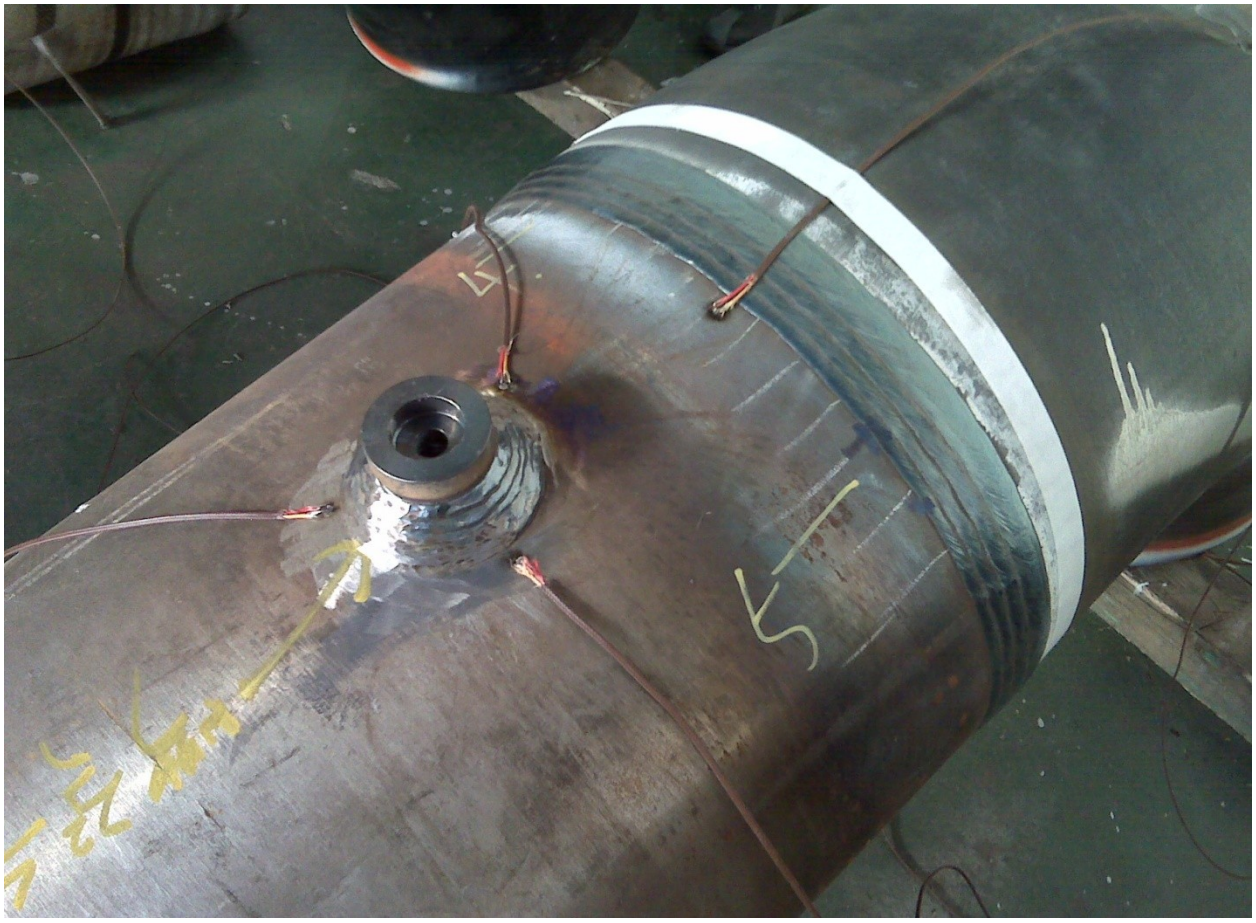
The PROHEAT is ideal for PWHT applications involving on-site welding of power plant piping subassemblies. Thermocouples are attached to the pipe according to procedure then covered with reusable woven silica PWHT insulation. The coil is then wound around the outside of the insulation, easily staying in position, even on vertical pipe.

PWHT – Small Diameter Pipe



In this small diameter pipe application (app. 75 mm), a test is being conducted to determine the least number of turns required to establish a load sufficient for the PROHEAT to run at a load without faulting. It is very common for the PROHEAT to run at a power level much less than 35 KW for small part heating applications. KAOWOOL should not be used for industrial heating applications.

Weldolet PWHT



All PWHT applications require temperature feedback to control power source output for heating rates and soak temperature requirements called out in the specifications. The number of thermocouples and their locations are usually specified in the PWHT procedure.

PWHT – Spread Coils Around a Weldolet

Coils can be easily spread apart to balance temperatures if needed. In this application, the small diameter weldolet shown in the previous photo is covered by the PWHT insulation and the coils are slightly flared apart to uniformly heat around it.

PWHT – Wide Zone

Coils do not have to be right next to each other for every application. Often, the coil is not long enough to span the entire heating zone with coils tightly wound. In this example, the coil is created with a 3” to 4” (75 to 100 mm) gap between the turns. Maximum heating occurs directly under the cable, but fills in evenly between the cables with time.

Drill Pipe Preheat – 2 Zones

More than one location can be heated easily with one heating cable if the part geometry is the same, and the temperature requirements are the same. In this PWHT application, similar drill pipe weldments are being heated using one PROHEAT output cable and one heating cable. Although not shown here, pipe caps or end plugs should be used whenever possible to help retain heat.

Drill Pipe PWHT – 4 Locations – 2 Cables

This is another drill pipe application where 4 locations are being heated at the same time using two PROHEAT output cables and 2 heating cables. It is important that the geometry and temperature requirements are the same when using both of the PROHEAT's outputs, because there is no independent control of each.

PWHT – Lab Testing

Temperatures are very uniform using induction heating coils from 12 o’clock to 6 o’clock on a test pipe.

P91 – Header PWHT in China

Most procedures for PWHT of P91 and P92 power plant piping call for 1400 F. (760 C) degrees for a soak temperature target. It is very important to minimize heat loss by adding insulation on both sides of the coil to retain heat.

P92 PWHT 20 Inch Diameter – 90 mm Wall

A heavy wall, P92 pipe section is being heated to 1400 F (760 C) in a PROHEAT trial to make sure that the heat soaks through to the ID of the pipe. Note the thermocouple mounted to the ID.

High Temp PWHT

This is a high temperature PWHT application common for 9% chrome alloy piping showing two thermocouple readings above 1400 F (760 C). Note that the recorder has documented the controlled heating rate up to the soak temperature as well as the very tight temperature control during soak.

P91 PWHT

A large diameter P91 pipe requires localized stress relief at the weld. **ALWAYS** suggest to your customers that additional insulation **AND** plugging the pipe ends will improve the heating rates and the chance for successfully heating to soak temperatures called out by the procedure.