



PIPING AND NICKEL ALLOY SOLUTIONS FOR NUCLEAR ENERGY





INTRODUCTION

Driven by aging and inefficient fossil power plants, as well as environmental pollution concerns and volatility in gas prices, a world-wide renaissance is emerging for the construction of new nuclear power plants for base-load electrical power generation.

PCC Energy Group combines the talents, technologies and capabilities of Wyman Gordon, Special Metals Corporation, PCC Rollmet and Klad to offer a unique line of metallic products not available from any other single supplier.

The companies that make up PCC Energy Group are prepared to meet the demands of new nuclear power-plant construction with seamless pipe, tube, forgings, rolled rings, bar, rod, plate, sheet and clad-overlay products. We supply these items in a variety of alloy types, including carbon steels, stainless steels and nickel alloys. We also manufacture nickel alloy welding products that complement the full line of nickel alloy products we produce.

CAPABILITIES

Pipe and tube products are widely used within a nuclear power plant. From PCC Energy Group we supply many of those essential products, including: Primary and secondary reactor coolant loop piping, surge lines, steam generator tubing, essential service water, and turbine feed lines. We produce seamless tube from 1/2" thru 8" NPS, and seamless pipe from 8" NPS thru 48" NPS, all in a complete range of wall thickness from Sch 10 to Sch 160, and well beyond.

Our seamless pipe and tube is either cold-drawn, cold rolled or hot extruded at one of our several plants locations in Houston, TX; Huntington, WV; Livingston, Scotland; Hereford, UK; Burnaugh, KY and Irvine, CA. Alloy bar products are used for fabrication of many reactor components including valves, nozzles, shear caps and plugs. Alloy plate is used for divider plates, support plates, baffles, stub runners, tubesheets, and plate heat exchangers.

Special Metals Welding Products Company makes a complete line of nuclear-grade welding products for joining alloy components and overlaying steel parts. INCONEL™ filler metal 52M and welding electrode 152M are specially formulated to provide outstanding resistance to hot cracking. Weldments deposited with INCONEL™ filler metal 52MSS and welding electrode 152MSS are resistant to ductility dip cracking (DDC), a cold cracking problem inherent in some alloy 690-type welding products. INCONEL™ 52M Weldstrip is widely used for overlay of heavy section steel tubesheets for nuclear steam generators.



From some of the largest extrusion presses in the world, manufacturing seamless, heavy-wall pipe in a range of materials, including carbon steel, stainless, nickel alloy and titanium grades.



Recognized for its 100-year history as a world leader in the invention, production and supply of high-nickel, high-performance alloys.



The largest and most versatile fittings manufacturer in the world, with products ranging from commodity to high-end, heavy-wall fittings and components.



Producer of large-diameter, seamless pipe and tube, in nickel alloys, stainless steels and ferritic alloys.



Producer of 52M wire overlay of pipe systems, co-extruded clad pipe and bonded clad plate products.

NUCLEAR ISLAND

Pressurizer (PCC Components)
Maintains proper water volume within the Primary Coolant Loop

Reactor Pressure Vessel
Containment vessel for Reactor Core and Control Rod Mechanism

Surge Line (PCC Components)
Connects the Pressurizer to the Primary Coolant Loop

Steam Generators (PCC Components)
Where Secondary Coolant Loop Steam is generated from Primary Coolant Loop Heat

Hot Legs (PCC)
Carries heated water from the Reactor to the Steam Generators

Reactor Coolant Pump
Circulates water within the Primary Coolant Loop

Cold Legs (PCC)
Returns cooler water from the Reactor Pumps to the Reactor Core

Crossovers (PCC)
Piping connecting return water from the Steam Generators to the Reactor Coolant Pumps

STEAM GENERATOR
CUT-AWAY VIEW

Tube Bundle (INCONEL™ 690T Tubes)
The steam generator tubes for most modern PWR's are manufactured from nuclear grade INCONEL™ alloy 690. These high quality, small diameter, thin wall, heat exchanger tubes require special melting and processing to ensure that the alloy structure will provide full resistance to primary water-stress corrosion cracking. The tubes are thermally treated after annealing, to optimize their microstructure.

Tube Support Plates (INCONEL™ 690T Plate)
The tube support plates control the alignment of the steam generator tubes and stiffen their array. Since these baffle plates are exposed to same environment as the tubes, they, too, are fabricated from solid nuclear grade INCONEL™ alloy 690 plate.

Tubesheet (INCONEL™ 52M Weld Overlay)
The tubesheet for the tube bundle of some reactors is fabricated from heavy section, solid INCONEL™ alloy 690 plate. However, to control costs some current designs build the tubesheet from heavy steel plate and weld overlay it. INCONEL™ Weldstrip 52M was specially designed for this application.

Divider Plate & Stub Runner (INCONEL™ 690T Plate)
The INCONEL™ alloy 690 divider plate separates the cold leg from the hot leg of the channel head as the primary water enters the steam generator. It is normally welded to the channel head. It is attached to the tubesheet by the stub runner which is also fabricated from INCONEL™ alloy 690 plate. INCONEL™ filler metal 52M is used for joining these components.

NUCLEAR APPLICATIONS

PCC Energy products are widely used for fabrication of components for nuclear service. Many product forms in various steels and alloys are manufactured.

The PCC Energy Group offers a unique combination of metal-working capability, technology, and outstanding metallurgical know-how for the most demanding applications. We manufacture many components for nuclear power plants and spent-fuel storage—and we've been doing it for more than 40 years.

From carbon and alloy steels, austenitic stainless steels and exotic nickel alloys, with restricted or special chemistry capability, the PCC Energy Group can melt, extrude, draw, forge, roll and weld overlay for your nuclear applications.

Many components of pressurized water reactors (PWR) are manufactured from nickel-base alloys. While other alloys have been used in the past, INCONEL™ alloy 690 is by far the most widely used alloy in today's safe, efficient, economical reactor designs. With its contents of nickel and chromium, alloy 690 offers excellent resistance to stress corrosion cracking in nuclear water and steam service. Steam generators, which use the heat from the nuclear reaction to produce steam to drive the power turbines, tubes, tubesheets, baffle plates and support plates, are fabricated from alloy 690. On the reactor shell, control rod drive mechanism nozzles and other entries are machined from large diameter alloy 690 bar or forgings.

In addition to alloy 690, INCONEL™ alloy 600 and INCOLOY™ alloy 800 are also used for fabrication of steam generator tubes. Tubes for Candu reactors are often fabricated from alloy 800 and offer excellent service in that reactor design.

The large pipes that return the spent steam to the reactor for reheat are typically manufactured from grade 300 stainless or austenitic stainless steel. Wyman Gordon's large extrusion presses are used to manufacture these pipes. We also provide stainless steel overlay on carbon steel, when requested.

Super austenitic stainless steels are the lowest cost materials for resisting microbially-induced corrosion (MIC). Our INCOLOY™ alloys 25-6MO, 25-6HN and 27-7MO are primary candidates for this service. Pipe and a variety of fittings are required. These components are normally fabricated from alloy plate.

Springs for alignment and positioning of the fuel rods in the bundle have been manufactured from INCONEL™ alloy 718 and X-750 strip. These age-hardenable, nickel-base alloys offer excellent strength and fatigue resistance along with corrosion resistance in the high water flow conditions encountered in the fuel rod bundle.

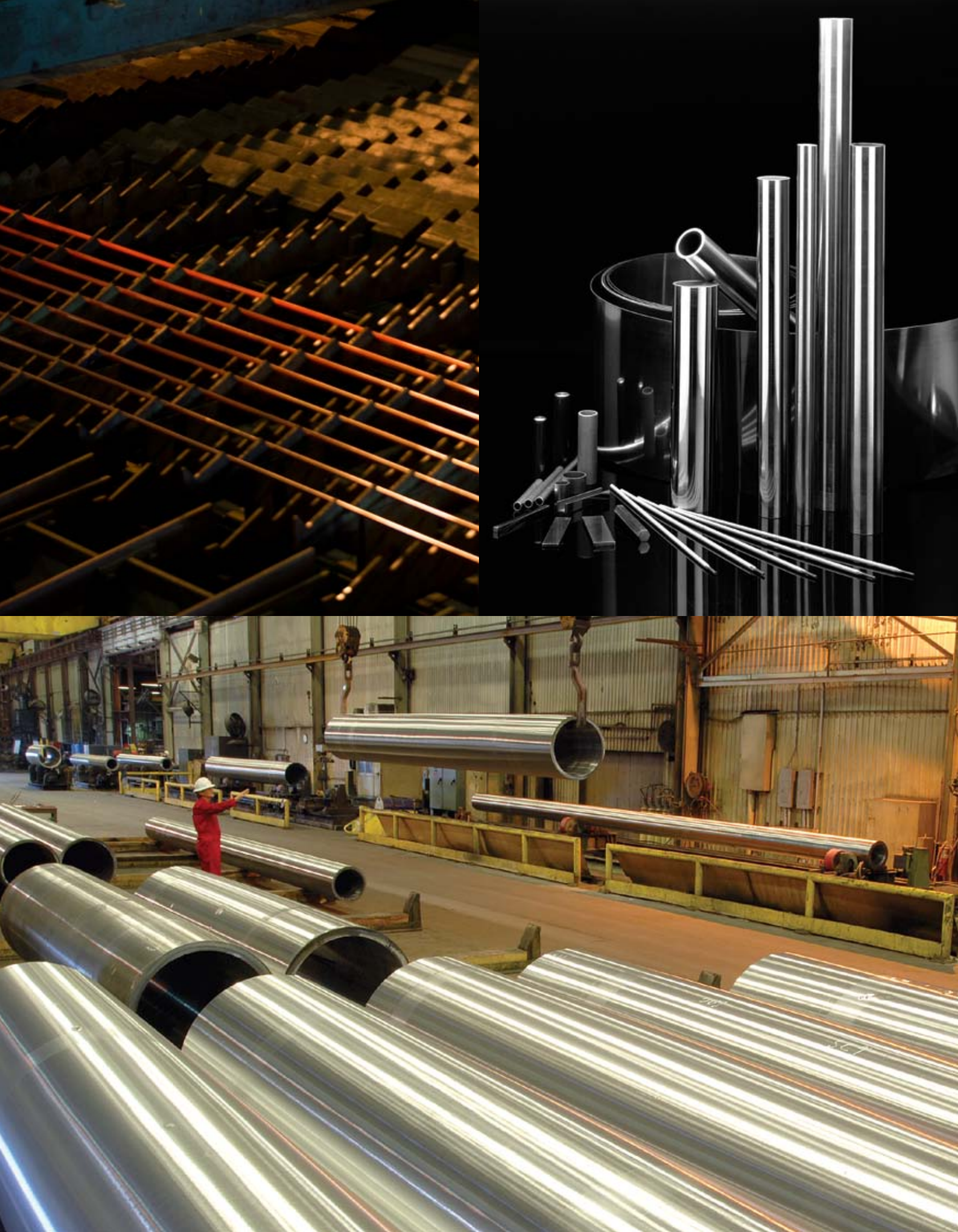
Whether your needs are for retrofit/upgrades on existing plants, new-builds for Generation III+ plants, or looking to the future toward Generation IV designs, the PCC Energy Group welcomes the opportunity to supply what you need.

AVAILABLE ALLOY MATERIALS

INCONEL™ alloys 25-6MO	INCONEL™ alloy 22	INCONEL™ alloy 600
INCONEL™ alloys 25-6HN	INCOLOY™ alloy 800	INCONEL™ alloy X-750
INCONEL™ alloys 27-7MO	INCONEL™ alloy 690	INCONEL™ alloy 718



Disposal of radioactive waste generated by nuclear plants requires special attention. PCC Energy Group is producing canisters for encapsulating radwaste for long-term burial. The canisters are built from corrosion-resistant alloy N06022, such as INCONEL™ alloy 22. Its excellent resistance to a variety of corrosive media has been judged acceptable to protect the volatile waste for the 10,000 years required for its nuclear decay.





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