

AEROSPACE MANUFACTURING TECHNOLOGY

Metal Forming

The NRC Institute for Aerospace Research (NRC Aerospace) has the expertise and facilities to investigate and develop technologies for forming metal products. Current research is underway in two main areas, forging and hydroforming of aerospace components.

Forging

NRC Aerospace helps Canadian industry develop precision forging capabilities for small engine parts through process development and optimization projects using a 250-ton isothermal forging press. Current projects are focussed on improving the forging of titanium and nickel-based superalloys.

Equipment specifications:

- 250 kN (25 ton) press with hydraulic power supply
 - Infrared radiant furnace (16 kW) for processing to 1200°C
 - Thermocouple reading
 - Inconel 718, Rene 80 and CM186LC compression anvils with silicon nitride inserts
 - Quenching as well as furnace and controlled cooling capabilities
 - Closed loop servohydraulic and computerized outer loop systems
 - Inert gas (argon) atmosphere.

- 2500 kN (250 ton) press with hydraulic power supply
 - Induction furnace heating (20 kW) for processing to 1400°C
 - Pyrometer reading from 400-1400°C
 - TZM compression anvils with silicon nitride inserts
 - Controlled cooling capabilities
 - Closed loop servohydraulic and computerized outer loop systems
 - Inert gas (argon) atmosphere.



250 ton forging press

Hydroforming

Studies are also underway to develop and optimize the production of aerospace engine components such as compressor blades and shafts using hydroforming, a technology that uses fluid pressure to shape a part against a mould or punch. To facilitate these studies, NRC Aerospace acquired a 1000-ton hydroforming press that can shape both tubular and sheet metal.

Hydroforming offers many advantages for aerospace component manufacture. Whole components can be made out of a single piece of metal, eliminating welded joints, and there is no material weakening because expansion is in all directions. Resultant parts are also fewer and lighter in weight, both of which lead to cost savings.

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Hydroforming press

- Position and force closed-loop control on all four actuators
- Position transducers allow a resolution of 0.013 mm (0.0005”) per count
- Load control transducers have a repeatability of 0.1% of full-scale.

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Equipment specifications:

- 1000-ton hydroforming press
 - Tubular or sheet hydroforming
 - Base plate: 1.6 m x 1.6 m (64” x 64”)
 - Distance between columns: 0.8 m x 0.8 m (32” x 32”)
 - Two side-feed actuators of 235,000 lbs force that can slew at up to 5.6 cm/s (2.2 in/s)
 - Main actuator: speeds up to 10 cm/s (4 in/s), 38 cm (15”) total stroke
 - 60,000 psi pressure intensifier delivers up to 39 in³ of water-based fluid; can also use 20,000 psi pressure intensifier for lower-strength alloys with the same control accuracy