The background image shows a complex industrial machine, likely for polymer processing. It features several large, horizontal rollers of varying diameters, some of which are illuminated with a bright orange glow, suggesting they are heated. The machine is supported by a sturdy metal frame with various cables and hoses attached. The overall scene is brightly lit, highlighting the metallic surfaces and the glowing rollers.

# CleanWeld

Thermal  
Bonding  
&  
Polymer  
Welding  
System

Tailor made

**CPR**  
AUTOMATION

## Infra- red Plastic Welding and Bonding

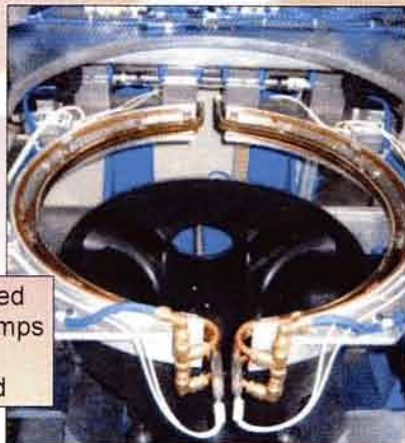
Infra-red (IR) welding and bonding are non-contact thermal techniques capable of producing very strong, air-tight joints in thermoplastic parts. When IR energy is used in a directed and controlled manner, the heating and melting of polymer parts can be accomplished very quickly. By immediately pressing two molten parts together, a welded joint can be formed quickly, cleanly and accurately. Similarly, fabrics and paper can be pressed into a thermoplastic polymer when molten to form a thermally bonded joint.

We are all familiar with infra-red energy because that is the heat energy we feel when exposed to sunlight. Energy absorption varies with differing materials or even with different colours of the same material.

As a source of controllable energy for industry, infra-red is produced by emitters sealed inside quartz tubes. Each emitter (lamp) is designed to radiate a particular frequency or wavelength. For IR welding or bonding of a particular colour and composition of a thermoplastic material, a specific wavelength will provide optimum results.



Typical Lamp Array



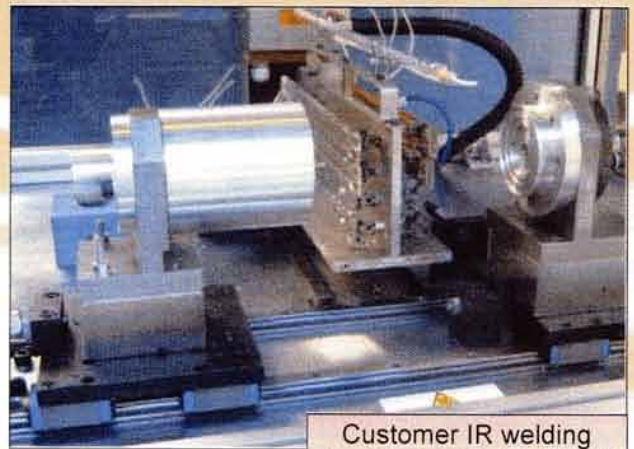
Specially shaped semi-circular Lamps for 500mm diameter weld

## IR Welding – The Process

Infra-red welding is a sequence of straight-forward operations:

- Load the components to be joined.
- Apply Infra-red energy until the mating faces are suitably molten.
- Press the two components together.
- Cool the joint until it solidifies.
- Unload the finished assembly.

Nothing could be simpler – provided that tooling is properly designed and each process step is optimized. Correctly configured, IR welding will produce a joint as strong as the parent material.



Customer IR welding development trial at CPR

## IR Bonding – The Process

The infra-red bonding process is very similar to the welding process above except that it applies to joining dissimilar materials to thermoplastics. Only the thermoplastic is melted before the two components are pressed together. The bond occurs, frequently at a microscopic level, as the molten material solidifies after flowing into surface irregularities in the other material.

Whether welding or bonding, tooling design and process profile (energy input and timing) are critical to achieving a good joint. Design of the thermoplastic components can also influence the joint characteristics, particularly where aesthetics are important.

With a wealth of knowledge gained from past experience, CPR Automation can advise on product design as well as undertake tooling and process trials.

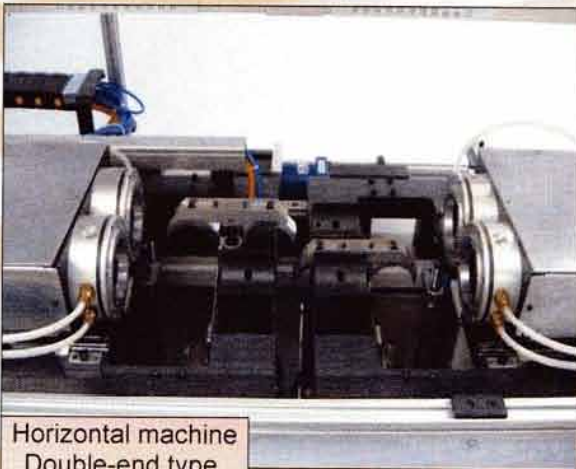
## Infra-red Process Machines

CPR Automation Limited has over 40 years experience of designing and building process machines for users in diverse industrial sectors. Always striving to be at the forefront of new technologies, CPR has developed a range of standard configurations of machines for infra-red welding and bonding.

Within each machine configuration there are many optional features that enable most clients' needs to be met with minimal customization. If standard machines are not suitable, CPR has the blend of skills and expertise to produce bespoke machines or complete production cells.

## Standard Machine Types

Tremendous versatility is provided from standard machine configurations with multiple choices of horizontal or vertical component loading, lamp box (the lamp array in a housing) size and shape, component clamping, shield gas, etc. Typically double sided lamp boxes are used for IR welding applications and single sided for IR bonding.



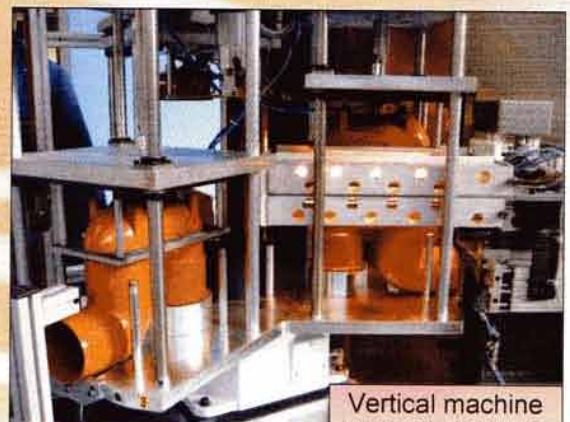
Horizontal machine  
Double-end type,  
Twin tooled



Horizontal machine  
Single-end type

To complement the variety of machine configurations there are choices of machine control and HMI (operator interface panel). A programme for a particular joint will include, the melt parameters, shield gas flow, and cooling time. The programme can be easily created on the HMI and saved for later re-use.

Generally, a manually loaded single-end machine would have only a small programme storage capacity and a low specification HMI. A double end machine, perhaps with tooling for three products per load, would demand a higher level control which could also support a higher specification HMI. At this higher level, the HMI could display other useful data, such as production statistics and machine maintenance information.



Vertical machine  
Rotary index type

## Options and enhancements for Standard Machines

- Interchangeable lamp boxes for different sized components.
- Closed loop temperature control for improved quality control and energy conservation.
- Water cooling to fixture locations for improved quality control and reduced cycle times.
- Chiller for use with water cooled tooling.
- Vacuum generation options for component retention.
- Pneumatic or servo control of press action to form the joint.
- Shield gas shrouds for quality control.

## Non-standard equipment

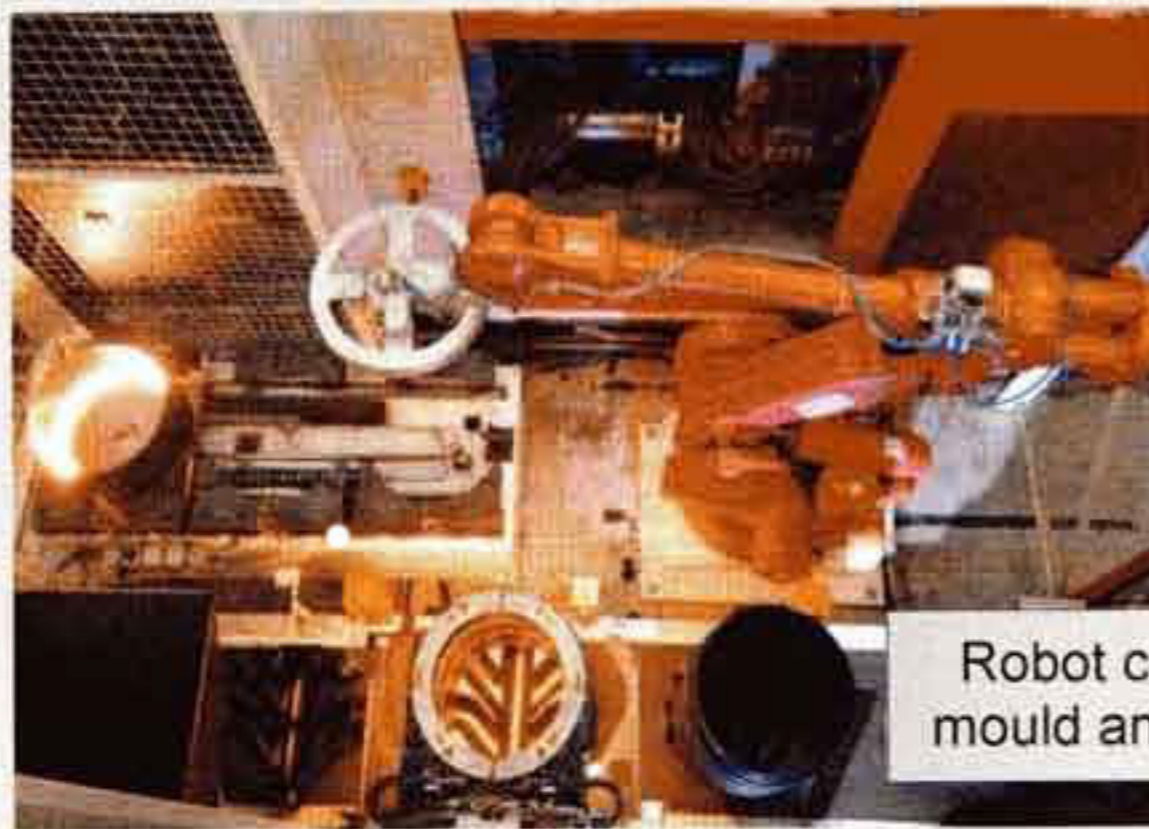
Machines are supplied in standard configurations for users to tool up and programme. Alternatively, CPR Automation will undertake design and manufacture of the tooling, programming, installation and commissioning.

## Application-specific equipment for standard machines

- Fixturing (with mechanical or vacuum clamping) and IR masks for components.
- Quick change features on tooling for reduced batch change over time.
- Bespoke profiled IR emitters (lamps) for 3D joints and reduced energy costs on large components.
- Auto loading and unloading.
- Product length compensation (for filter end-cap bonding applications).

## Specially engineered solutions

For special circumstances CPR Automation can provide other solutions. For high volume production or for products too large for standard machines, bespoke machines or complete systems can be provided.



Robot cell to de-mould and IR weld

Special high speed rotary index machine



## Benefits of infra-red Welding and Bonding

As infra-red is a non-contact melt process it is much cleaner than hot plate welding, leaving no product residues.	No down time for cleaning off residues. No aesthetic contamination of the product from residues. No structural impairment of the joint from residues.
Infra-red energy is instantly controllable and therefore is more energy efficient than hot plate welding.	No mass of metal to pre-heat before production start-up and then maintain at temperature throughout a batch run. IR lamps are switched to minimum power during loading, cooling and unloading stages, saving up to 60% energy costs.
Because infra-red energy is instantly controllable, joint quality is more controllable than in hot plate welding.	Rate of energy transfer into the product can be varied directly within the programme or in response to a closed loop temperature control system. This allows greater melt depth without surface damage.
The IR process can be faster and more cost effective than adhesives (especially for fixing end caps to filter media).	No separate adhesive to be purchased, stored, pumped and metered because the parent material melts and flows to create the bond. There can be further time and cost savings against adhesives that require heat or UV curing.

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