

# Narrow-groove Welding System

## Background

Narrow-groove welding has developed significantly during the past decade, and its benefits are becoming widely recognized. Reduced weld (at least 70 percent less when compared to conventional grooves) production rates and reduced residual stresses are among the many advantages of this technique.

Additionally, narrow-groove welding processes use a groove with zero- to five-degree sidewalls instead of the traditional 37.5-degree weld prep. This narrow groove requires far less filler metal and time to complete the weld, and also lowers the residual stress resulting from cooling of the weld metal.

The narrow-groove welding equipment was designed for both high weld quality and optimal usability.

- Custom weld heads exclusively employ the industry-leading Eclipse II™ Vision System, which provides optimal visibility of the molten weld pool.
- The specialized shielding system was designed for effective gas shielding.
- Westinghouse employs an innovative argon flood cup to protect the molten weld pool.
- The welding equipment is designed for remote operation, enabling welding operators to perform weld installation away from adverse welding environments.

## Description

The narrow-groove welding system consists of a power supply with integral programmer, a weld head, the Eclipse II operator station, and a track and control pendant. It is intended for field use where weld quality requirements are stringent. These weld heads have been designed specifically for reactor coolant loop welding applications.



Narrow-groove weld head

Narrow-groove welding system consists of:

Gold Track VI power supply

- Weld head with Eclipse II weld viewing system
- Eclipse II touch-screen operator control station
- Weld head cabling (includes power and ground)
- Fiber-optic cabling
- Control cabinet interconnect cabling
- Fully motorized weld head (for remote operation)

The following functions are programmable:

- Carriage travel speed
- Wire feed rate
- Automatic voltage control torch height control
- Torch oscillation speed and width
- Primary and background welding current and voltage
- Synchronization of current, voltage, wire feed and oscillation
- Low-current arc initiation to avoid tungsten inclusions
- Wire manipulation, iris and lamp intensity settings

## Touch-screen Operator Station Controls

The narrow-groove welding platform uses a touch-screen control terminal for all operator controls (welding power supply communication/video control/wire manipulation). The touch-screen terminal communicates with a programmable logic controller (PLC) in the work location to direct the weld head, video controls and operations.

The Eclipse II vision system provides a discernible video monitor image throughout wide current and voltage ranges, with both pulsed and continuous currents. This approach provides a uniform image of the arc, the weld pool and the surrounding area. Several methods for light attenuation have been incorporated in the Eclipse II vision system. The key to the system is regionalized filtration, which provides a means to obtain optimum filtration for any area within the field of view.



Eclipse II operator station

Additionally, the filter region itself is remotely adjustable, both in size and apparent density.

For arc-off inspection, the filter region is reduced in size until no longer visible. Adjustability accommodates a wide range of welding parameters, as well as various welding thermal cutting processes.

The narrow-groove welding system completes all welds remotely in ambient temperatures up to several hundred degrees.

The Eclipse II operating station includes the following features:

- User-selectable screens that allow the operator to choose specific operations
- Programming menu that allows all welding parameters to be adjusted remotely
- Ability to save and retrieve all weld schedules from the program library
- Fiber-optic communication that is immune to electrical noise
- Functional control from up to one mile away
- Two video cameras, mounted to the torch assembly, to provide optimum view of the weld
- Picture-in-picture selectable screen views

## Benefits

- Extended remote capability
- Fiber-optic communication
- PLC communication with the touch-screen control panel for easy program setup and troubleshooting
- Extreme system flexibility
- Integration of complex controls
- Low maintenance costs
- Reduced dose and decontamination costs

## Experience

- Steam generator replacement projects
- Piping overlay projects
- Multiple canister projects
- Pipe replacement projects

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June 2015 NS-IMS-0035

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