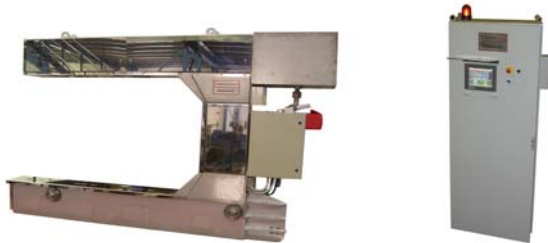


MDCV SERIES 83200 C-FRAME LASER THICKNESS GAUGE FOR THE PLATE MILL



Gauge shown in off-line position



NOW IN OPERATION

BHUVEE PROFILES & STAINLESS MILL ORISSA

- **Totally protected by "external" suspended water cooled radiators and insulated reflectors**
- **High accuracy as automatic zeroing and temperature compensation algorithms**
- **Automatically calibrates off on-line Certified Standard on each insertion.**
- **Single spot or multi-point options for full plate profile**
- **Lower cost than Isotope and X-ray Thickness Gauges**
- **Measures all thicknesses independent of alloy content**
- **Lasers in independently water cooled chambers**
- **Resistive touch screen Pentium PC with user friendly graphics in floor standing cabinet**
- **HCPI software algorithms address frame expansion and alloy hot/cold conversion rates**

General Description

This Laser Thickness Gauge is purpose built to determine the thickness of the hot plate at the Reversing Stand in the Plate Mill.

The Gauge utilizes Class II Laser Triangulation Meters to determine both the thickness of the plate and at the same time to automatically calibrate off a Certified master plate sample that identifies distortions in the Gauge C-Frame due to ambient and radiant heat changes. In addition, the frame temperature is monitored by implanted thermocouples that are used in the Gauge Controller algorithms. By this means this Gauge automatically compensates for any distortions and provides high-resolution thickness measurement regardless of the effect of such influences.

Whilst other Thickness Gauges are unable to provide accurate measurement off both thick and thin plate from one Gauge and require calibration for the various steel alloys, this Gauge operates over a wide plate thickness range, as well as measuring turn-up, and is totally unaffected by alloy content. In addition, there are no x-ray or radioactive isotopes that need to be controlled when in use.

Operates via Kontron PC104 Pentium 3 VX Windows Controller mounted in floor standing cabinet with flat resistive touch screen and user friendly graphic display. Converteam HCPI software addresses expansion algorithms for 10 alloys and provides hot/cold conversion of plate thickness.

Unique Construction for Dimensional Stability

The C-Frame is purpose built from heavy steel construction and flanged I-beam support to maintain dimensional stability with changing ambient and the high radiant heat emitting from the hot plate as it passes through the Gauge. The rigid C-Frame is furthermore encased and protected by plant fed water-cooled radiators suspended/secured to its Frame that in turn are protected by ceramic board insulation and shiny stainless reflector panels. As added security the lasers themselves are mounted within water cooled chambers from closed loop water chiller.

Laser - The Total Solution For All Hot Plate Thicknesses

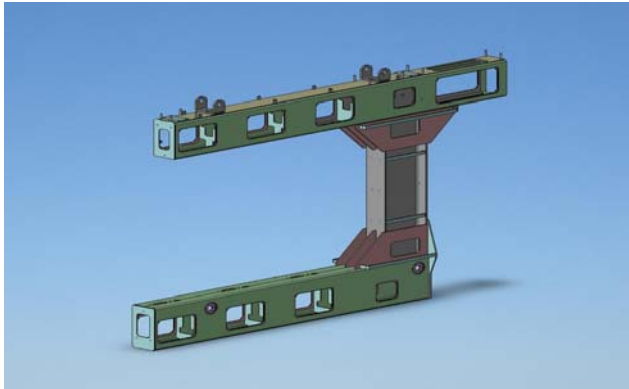
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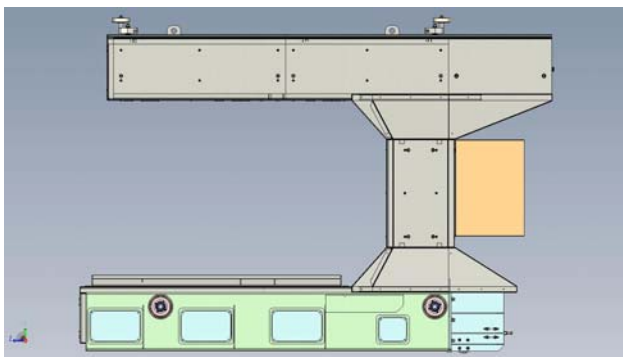
Each individual aspect of the Gauge C-frame design addresses the need for total stability and ease of maintaining it in the harsh environment of the Plate Mill that it must operate.



The C-Frame with the Covers off

Shows the frame with the external radiators removed and the cantilever construction to ensure minimum distortion with changing ambient. Further maximum rigidity is assured through use of strengthened compartments and a substantially robust vertical I-beam construction with flanges for rigidity.

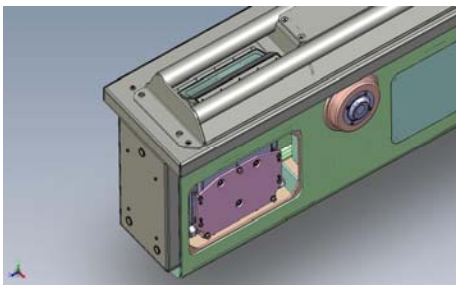
Note the clear access provided to each Laser compartment which in turn have there own closed loop water chilled supply to maintain the Laser at a constant temperature.



The C-Frame with the Covers on

Shows the Gauge C-Frame (excluding the protective insulated reflector panels) with all the Water cooled radiators in place.

Note that all exposed faces of the top arm and bottom arm as well as the vertical beam are protected by totally encasing water cooled Radiators. These are in turn further protected by the insulation panels behind stainless reflector panels.

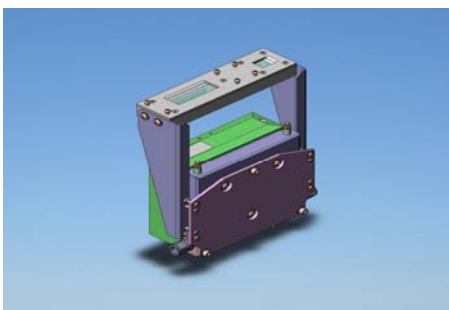


Lower Laser Window & Laser Compartment

Shows the flush fitting "sloped" tempered glass Laser window within the robust protective cage rollers to minimize potential contaminate build up and damage.

An air wipe is also provided across the glass via the internal frame air supply from a remote powerful fan or site air supply.

Note the clear access for the Laser replacement, adjustment and cleaning.

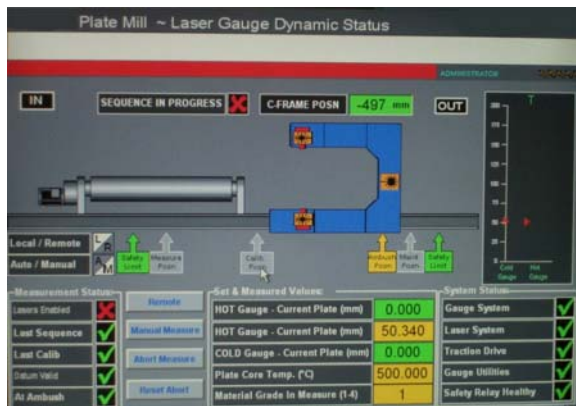


The Laser Assembly

The Laser unit is secured to its independently water cooled radiator which in turn secured in an A-Frame for alignment adjustment on both axis.

It is important to note the both top and bottom Lasers must be perfectly aligned for the true plate thickness to be measured. This technique also enables replacement of the Laser without re-aligning

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One of several Graphic displays. This shows the Thickness Gauge while in operation.

Auto Zeroing Calibration

All Changes in the C-Frame throat dimensions are automatically compensated for. Incorporated lasers measure off a master plate (to Certified Standard) mounted between the C-Frame and the line, thickness of which is measured each time the gauge moves from ambush position to over the line. This thereby automatically zeros the measured thickness to the master sample.

In addition, multiple thermocouples are fitted to the C-Frame that continuously monitor the C-Frame temperature. These are inputted to an established algorithm for calibrating the gauge movement to further zero the measured thickness output and provide exceptional accuracy over a wide thickness range.

Model Options

Three Thickness Gauges are available with differing combination of measuring lasers. Namely:

MDLC832001-B: Incorporates two Laser Triangulation Meters measuring centre plate thickness. Automatically calibrated off Certified sample each time the C-Frame moves in across the line.

MDLC832004-PF: Incorporates four Laser Triangulation Meters providing plate profile by measuring centre thickness and near side edge thickness. Automatically calibrated as the C-Frame moves in across the line.

MDLC832006-CPF: Incorporates six Laser Triangulation Meters providing plate profile by measuring centre thickness and both edge thicknesses. Automatically calibrated as the C-Frame moves in across the line.

Gauge Functional Sequence

- On powering up via the Controller Cabinet the Lasers self test and confirm available for measurement.
- On receipt of this system ready output and the plate is within measuring limits the Gauge can be driven onto the line.
- Measurement data is collected each 10 ms as a rolling average of last 50 spot values from the Lasers and outputted each 10 ms.
- Out of tolerance rogue samples are rejected as top/bottom pairs to maintain synchronisation of the data collection
- Once valid values are collected for 1 second rolling average from matching Lasers, an output indicates valid data.
- The established valid uncompensated Serial Com's data is transmitted to the Controller for the current position of the Lasers.
- Where corrupted/invalid data, this output will de-energise and indicate corrupted or out of range.

Performance Specifications of the Gauge

Plate thickness to 10 micron resolution and standard deviation via moving average analysis measurement off plates from 3 mm to 180 mm thickness. Accuracy guarantee 150 micron as mean value from rolling average output. Leading and trailing edge values removed. Plate thickness determined on the turn up where up to 70 mm from the pass line and where greater than 150 mm this range is reduced. Gauge outputs converted to cold plate value with reference to 10 in-built alloy cooling curves.

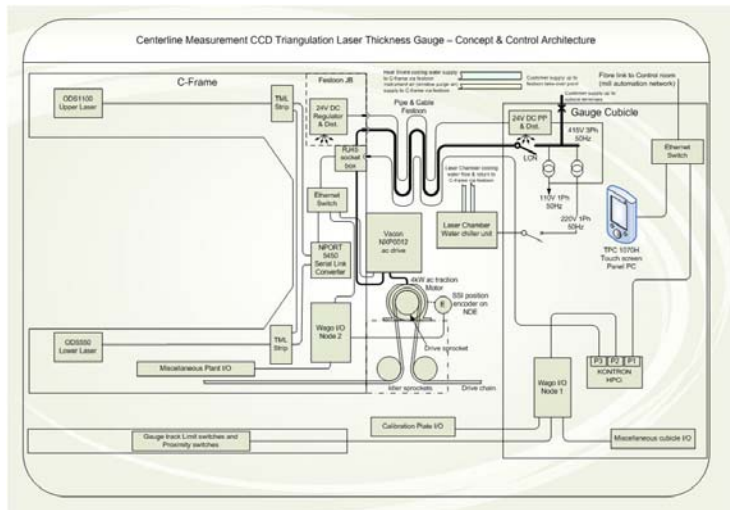
Where no plate turn up, or this not to be measured, then repeatability can be substantially improved. Hot slabs of up to 400 mm thick can be accommodated by raising of the C-Frame and implementation of larger range Lasers. In this case thickness would be determined in the region of 100 micron repeatability.

For cold lines and higher accuracy requirements refer to our Series 700 Gauges. These Gauges have the water cooling, insulation and reflector panels removed from the C-Frame.

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Control Architecture



Controller Interfaces and Functions:

Local Keyboard and user friendly menu display
With flash memory for specific requirements

Automatically starts the Laser Measurement
Provides synchronisation to Lasers
Supply 24 VDC supply to the Lasers
Supply RS422, 38400 baud Output to Gauge PLC

Gauge PLC digital Interface I/Os –

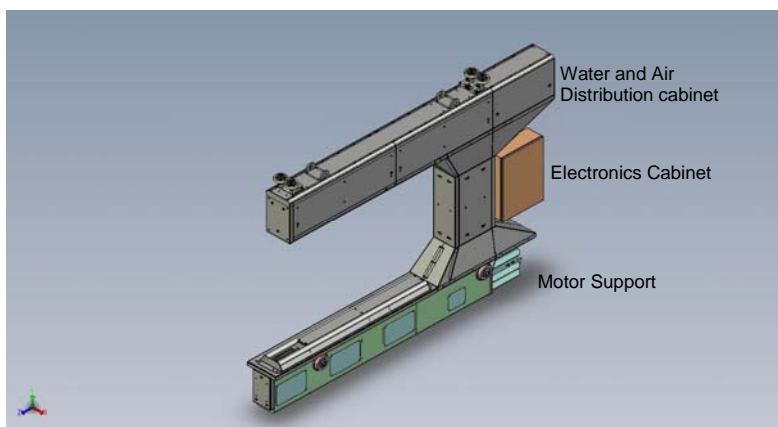
Input to CPU – Activate / allow measurement
Output – System healthy/ready for measurement
Output – CPU measurement valid /OK

Serial Communication data links –

RS 422/485 Com port at 38400 baud rate measurement values from as rolling average

C-Frame

Without running rails and top supporting monorail in place



General Specifications -

- Secondary temperature compensation distortion determined via algorithm thermocouple inputs.
- C-Frame distortion calibrated off Certified Master on each insertion onto line from ambush position.
- Stated measurement repeatability calibrated over 20° to 50°C operating range

- Line insertion width requirement - Max width of frame 290mm including bottom arm wheels
- Built in Traction Control with auto input and extraction provided
- External Radiators and reflectors fabricated from Stainless Steel
- Air wipes provided on Laser windows via motor room air supply or air blower
- Accommodates insertion of Velocity Meter via periscope

- Maximum plate temperature 1200° C
- C Frame throat depth - up to 4,200 mm
- Maintained Laser Chamber internal temperature +35° C
- Frame Dimensions - Length 2250 mm where up to 3 Laser, Height 1950 mm (Variable), Width 290 mm, excluding wheels
- Frame throat height - 1445 mm (Variable between 200 to 1800 mm according to performance spec requirement)
- Lasers accommodate plate falling 30 mm below pass line and top surface up to 180 mm above pass line