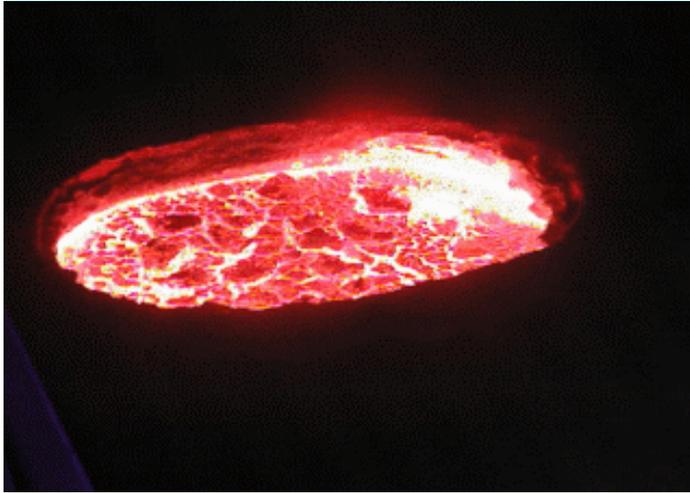


### ARGON STIRRING CONTROL & ARC MONITOR

RELIABLE

CONSISTENT

ACCURATE



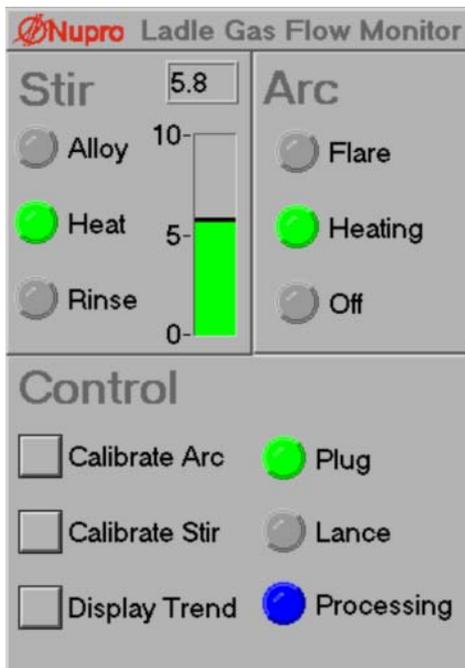
#### CLEAN STEEL PRACTICE

Experienced operators and metallurgists recognize the importance of accurate and consistent argon gas stirring in the ladle. Clean steel and good castability depend on a consistent and gentle rinse stir. During ladle arc reheating, slag line life and heating efficiency rely on an optimum medium stirring rate. Alloy addition and desulfurization require more vigorous but controlled stirring. To facilitate the reproducible and accurate argon stir rates and durations required to meet these objectives, Nupro Corporation has developed TruStir™, a vibration based argon stirring control system.

#### ADVANCED TECHNOLOGY

This is an advanced technology that uses an accelerometer and digital signal processing to deliver accurate gas flow measurement in ladle stirring applications. An accelerometer in contact with the ladle, shown at right, sends amplified signals to the system that filters and digitally processes the signals through a proprietary software package. The system is fully automatic, non-intrusive, and is customized and tuned on site to meet the specific needs of each ladle stirring operation.

The system is then fully integrated with the existing PLC to provide accurate and reproducible stirring. A customized operator interface with touch screen input is provided to suite for ease of use and convenience. An arc noise measurement option can be added to indicate excessive arc noise and recommend flux additions.



Custom user interface

#### IMMEDIATE BENEFITS

- ✓ lower argon consumption
- ✓ longer stir plug life
- ✓ better alloy recoveries
- ✓ improved desulfurization
- ✓ longer slag line life
- ✓ decreased nozzle clogging
- ✓ cleaner steel
- ✓ ability to "blind stir" at the caster
- ✓ real time stirring history
- ✓ optional arc noise level for optimal flux addition
- ✓ decreased arc flare
- ✓ improved arc reheating efficiency
- ✓ lower carbon pick-up during arc reheating
- ✓ typical payback in less than one year

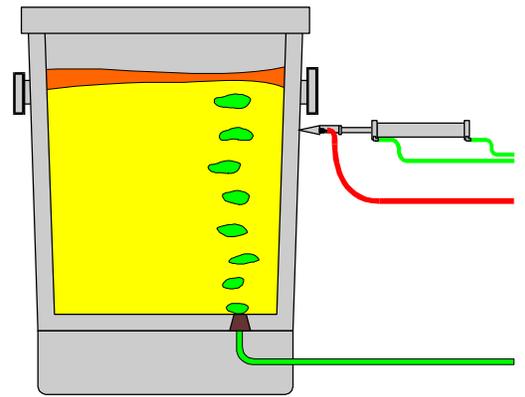
## TRUSTIR™: MINIMIZE PROBLEMS

In argon plug stirring, several conditions may hamper the ability to achieve and maintain the correct stirring energy in the ladle. Some problems include:

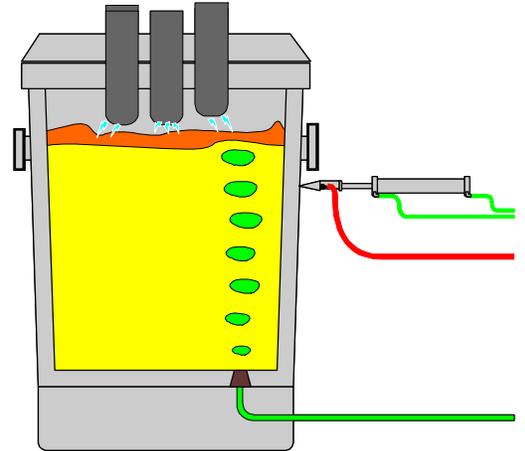
- ✗ argon channeling, resulting in lower than expected stir rate.
- ✗ leaks in the supply system.
- ✗ variable back pressure due to changing plug condition.
- ✗ operator error in judging the stir rate due to variable slag thickness and consistency.
- ✗ lack of real time record of stir history on each ladle.

These problems can be costly, with the following negative results:

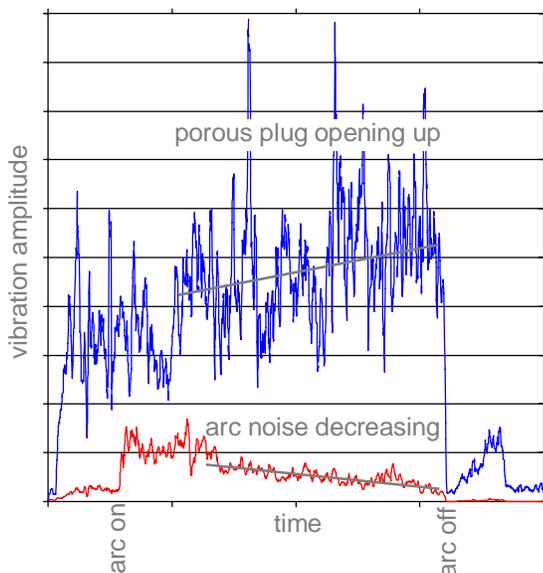
- ✗ excessive argon consumption.
- ✗ poor castability (nozzle clogging).
- ✗ aluminum fade.
- ✗ ladle slag line refractory wear.
- ✗ arc flare and low heating efficiency.
- ✗ inability to desulfurize.
- ✗ higher total oxygen in the final product.
- ✗ carbon pick-up during ladle furnace reheating.



Use for ladle stirring only or



at the ladle furnace.



Measured vibration amplitude at a ladle furnace (control disabled).

## IMPROVE PROCESS CONTROL

In present systems, the desired stir rate is set according to the argon supply flowrate. Unfortunately, the stirring energy actually achieved may not be proportional due to the abovementioned problems. TruStir™ alleviates these difficulties and ensures consistent and accurate stirring by monitoring ladle vibration, which is directly linked to stirring energy. In this manner, the argon flowrate is continuously adjusted to compensate for changing process conditions and thereby maintain a consistent specified stir rate.

As an example, the figure on the left shows the stirring energy increasing during the heating cycle due to opening of the porous plug. TruStir™ can sense the change in flow and compensate by adjusting the argon gas controller. The arc noise decreases after the addition of fluxes. Thus, during excessive arc noise periods, TruStir™ recommends the addition of fluxes to reduce arc flare.

TRUSTIR™: MAKE A GENTLE RINSE STIR A REALITY

CONTACT YOUR STIRRING PROFESSIONALS

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