Tenova Goodfellow is the Tenova Melt Shops’ Center of Excellence for process control technology. As the world leader in real-time off-gas process control, Tenova Goodfellow provides the highest quality and most technologically advanced industrial equipment and process control technology for the markets it serves. Through R&D partnerships with government, universities and industry leaders, Tenova Goodfellow works at the cutting edge in developing next-generation optimization control strategies.

BOF® TECHNOLOGY

BOF® is a breakthrough technology designed to reduce GHG emissions while improving yield, productivity and scrap-melting capability and cutting operating costs. BOF® technology delivers unprecedented value and an unparalleled level of customized control by employing a combination of reliable off-gas analysis, novel sensors and process models linked by a comprehensive automation system.

BOF® BRINGS PROVEN BENEFITS SUCH AS:

- Reduced Tap Alloys
- Reduced Consumables
- Increased Productivity
- Increased Yield
- Reduced GHG Emissions
- Improved Safety
- Reduced Maintenance & Repair
BOF® TECHNOLOGY

BOF® is a modular technology, available either as an integrated technology package or as independent standalone modules to meet the specific needs of each melt shop. The technology consists of:

- Module 1: Improved End-Point Detection to reduce conversion costs, improve yield and increase productivity, without costly Sub-Lance technology.
- Module 2: Intelligent Slopping Detection System to warn operators in advance of an impending slop to increase productivity
- Module 3: Optimized Post-Combustion to increase productivity from enhanced scrap melting;
- Module 4: Auto-Tapping Control to improve safety and minimize slag carry-over and tap alloy additions.

BOF® Technology employs key sensors and comprehensive process models to predict slag & bath chemistry and temperature from start to end of blow, for accurate end-point determination.

**MODULE 1: END-POINT DETECTION**

- BOF® End-Point Detection technology is based on industry-proven EFSOP® off-gas analysis, proprietary off-gas sensors to measure temperature, flow and pressure, and BOF process control models designed to enable "Blow & Tap" practice without the additional cost and delays associated with Sub-Lance technology. Thanks to its innovative features, BOF®:
  - predicts slag & bath chemistry and temperature from start of blowing;
  - alerts operators of the correct time to drop-in blow Celoc;
  - alerts operators when to pull the lance based on aim Carbon & Temperature.

**MODULE 2: INTELLIGENT SLOPPING DETECTION SYSTEM (ISDS)**

- BOF® slop-detection technology uses lance vibration analysis with real-time alerts to gas operators advance warning of the onset of a slop and a measurement of slop severity. The system is designed to provide direct feedback control of lance position and oxygen flow rate, for rapid mitigation of the effects of a slop.

**MODULE 3: OPTIMIZED POST-COMBUSTION**

- BOF® post-combustion uses EFSOP® off-gas analysis together with temperature, flow and pressure sensors and a dual-flow lance with independent control of primary and secondary oxygen to control secondary oxygen flow-rate, penetration and timing. The result is optimal post-combustion efficiency and scrap-melting capability with minimal refractory or lance wear.

With typical BOF blowing practice, 85%-90% of gas exiting the converter remains as uncombusted CO. This CO represents a significant amount of process energy, since full combustion of C to CO₂ generates 3.5 times more heat than partial combustion to CO. Controlled injection of secondary O₂ above the lance tip promotes in-converter combustion of CO to CO₂, providing additional energy for higher productivity from increased scrap melting.

**MODULE 4: AUTOMATIC TAPPING CONTROL**

- BOF® auto-tapping technology employs advanced image analysis together with process models to control tapping practice, in either an operator-assist mode or a fully automatic mode.

**BOF® End-Point Control Steel Plant Verified Benefits**

- Early End-Point, 95% of heats End-Point C, 97% of heats
- End-Point Temperature ± 13 °C
- Catch Carbon reduction is standard deviation 6.9%
- Oxygen savings 2.7%
- Ladle Carbon savings 2.7%
- Tap Perox Alloys savings 1.6%
- Tap Aluminium savings 4.0%

**BOF® Post-Combustion Benefits**

- 3 – 6% increase in scrap melting
- Skip mitigation from slag reheating
- Reduced ladle and mouth skulls

**BOF® Auto-Tapping Benefits**

- Decreased tap time and variability
- Reduced slag carry-over
- Reduced heat loss and aluminum consumption
- Up to 0.5% increase in yield
- Improved operator safety