

Soaking Pit Application Note

Soaking pits are necessary to heat up and soak metal ingots to a uniform temperature sufficient to allow passage through the various rolling stages of the mill.

Steel feed stock to the pits can be hot ingots from BOS plant, hot skelps (cast slabs or blooms) from CONCAST plant, or cold stock.

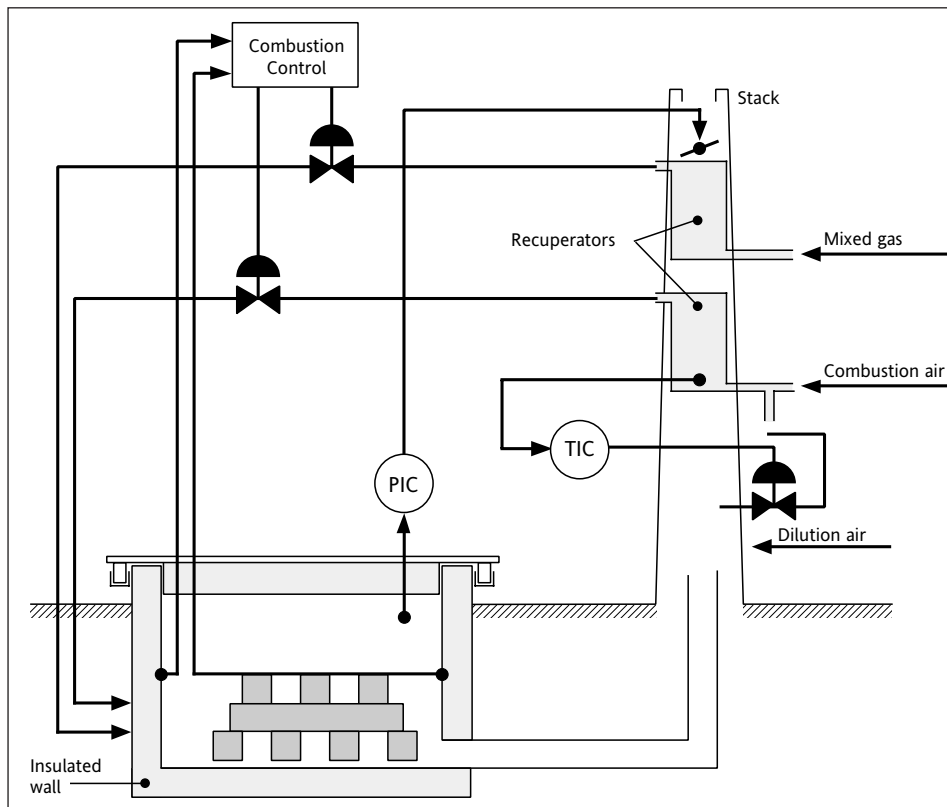
The rolling stages may be several, from Primary and Secondary mills through Scarfing, Roughing, Intermediate and Finishing mills.

As the ingots are being fed to the mills every few minutes but the heating and soaking cycles take hours (ingots weigh several tonnes), many soaking pits are needed to ensure availability of material to the mills 24 hours a day.

HEAT TREATMENT

- **Cross-limiting combustion control**
- **Temperature profiling**
- **Gas mixing station**

A soaking pit, see Figure 1, is a thermally insulated chamber with a top sliding lid to add or remove ingots. The pit is gas fired and therefore the continuous control requirements are temperature, gas flow, air flow and pit pressure. Further control could involve diluting the waste gas with air to maintain recuperator protection, and would include shutdown logic for over temperatures and low pressures.



Cross-limiting combustion control

A cross-limiting combustion control technique ensures that there is always an efficient ratio of air and fuel within a combustion process. This is implemented by always raising the air flow before allowing the fuel flow to increase, as shown in Figure 2, or by lowering the fuel flow before allowing the air flow to decrease. A combination of high and low select modules is therefore used in the implementation.

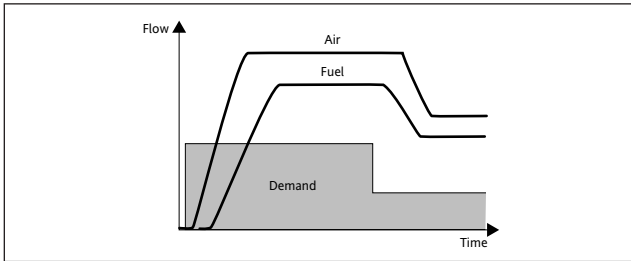


Figure 2 Cross-limiting combustion mechanism

Figure 3 shows a simplified control block diagram of the cross-limiting combustion circuit. Combination firing of two fuels can also be accommodated within the scheme.

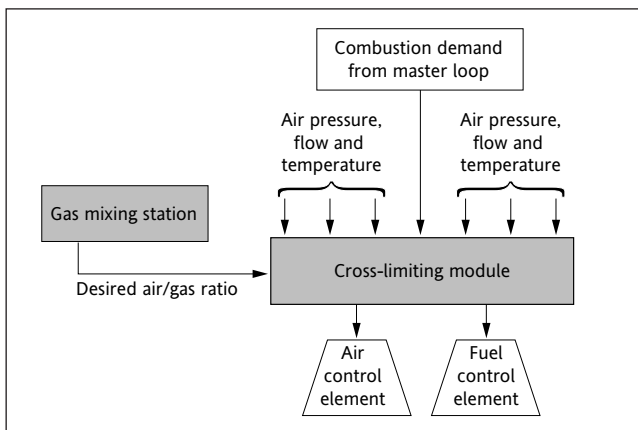


Figure 3 Cross-limiting combustion control

There are generally two thermocouples used in soaking pits, one at the burner wall and one at the end wall. The operator can select either, or automatically the highest, to generate the combustion demand for the control module.

Cross-limiting combustion control is highly effective and can easily provide the following:

- Optimisation of fuel consumption
- Fast adaptation to variations in fuel and air supplies
- Fast adaptation to types of fuel available

Double cross-limiting combustion control is an enhancement to the above. It is achieved by applying additional dynamic limits to air and fuel setpoints. This translates to having the actual air/fuel ratio maintained within a preset band during transitions. This method protects the demand signal driving the air/fuel ratio too lean and therefore reducing heat input.

Temperature profiling

The soaking requirements for the ingots in a pit vary according to the total load mass and thermal cycle. This is calculated in the supervisory system and a set of profiles is downloaded to the temperature controller by setting target temperatures and ramp rates.

Once downloaded, the front end instrumentation maintains the profile without further operator intervention.

Gas mixing station

The gas used for the soaking pits is a mixture of fuel gases from other areas of the steelworks such as BOS, Blast Furnace and Coke Oven gases. At the Gas Mixing Station, these gases are mixed by ratios, according to availability. Because of this, the calorific value of the mixed gas is variable. A mass spectrometer is utilised to calculate the Wobbe index from the specific gravity. The resultant ratio correction factor for optimum combustion is then fed to the combustion control module.

Eurotherm: International sales and service

AUSTRALIA Sydney
Eurotherm Pty. Ltd.
Telephone (+61 2) 9838 0099
E-mail info@eurotherm.com.au

AUSTRIA Vienna
Eurotherm GmbH
Telephone (+43 1) 7987601
E-mail eurotherm@eurotherm.at

BELGIUM & LUXEMBURG Moha
Eurotherm S.A./N.V.
Telephone (+32) 85 274080
E-mail info@eurotherm-belgium.be

BRAZIL Campinas-SP
Eurotherm Ltda.
Telephone (+5519) 3707 5333
E-mail eurothermltda@eurothermltda.com.br

DENMARK Copenhagen
Eurotherm Danmark AS
Telephone (+45 70) 234670
E-mail info@eurotherm.se

FINLAND Abo
Eurotherm Finland
Telephone (+358) 22506030

FRANCE Lyon
Eurotherm Automation SA
Telephone (+33 478) 664500
E-mail ea@automation.eurotherm.co.uk

GERMANY Limburg
Eurotherm Deutschland GmbH
Telephone (+49 6431) 2980
E-mail info@regler.eurotherm.co.uk

HONG KONG & CHINA
Eurotherm Limited North Point
Telephone (+85 2) 28733826
E-mail eurotherm@eurotherm.com.hk

INDIA Chennai
Eurotherm India Limited
Telephone (+91 44) 24961129
E-mail sales@eurothermdel.com

IRELAND Dublin
Eurotherm Ireland Limited
Telephone (+353 1) 4691800
E-mail info@eurotherm.ie

ITALY Como
Eurotherm S.r.l.
Telephone (+39 31) 975111
E-mail info@eurotherm.it

KOREA Seoul
Eurotherm Korea Limited
Telephone (+82 31) 2738507
E-mail help@eurotherm.co.kr

NETHERLANDS Alphen a/d Rijn
Eurotherm B.V.
Telephone (+31 172) 411752
E-mail sales@eurotherm.nl

NORWAY Oslo
Eurotherm A/S
Telephone Oslo (+47 67) 592170
E-mail info@eurotherm.se

SPAIN Madrid
Eurotherm España SA
Telephone (+34 91) 6616001
E-mail ventas@iberica.eurotherm.co.uk

SWEDEN Malmo
Eurotherm AB
Telephone (+46 40) 384500
E-mail info@eurotherm.se

SWITZERLAND Freienbach
Eurotherm Produkte (Schweiz) AG
Telephone (+41 55) 4154400
E-mail epsag@eurotherm.ch

UNITED KINGDOM Worthing
Eurotherm Limited
Telephone (+44 1903) 268500
E-mail info@eurotherm.co.uk
Web www.eurotherm.co.uk

U.S.A. Leesburg VA
Eurotherm Inc.
Telephone (+1 703) 443 0000
E-mail info@eurotherm.com
Web www.eurotherm.com

ED48

© Copyright Eurotherm Limited 2006

Invensys, Eurotherm, the Eurotherm logo, Chessell, Mini8 and Wonderware are trademarks of Invensys plc, its subsidiaries and affiliates. All other brands may be trademarks of their respective owners.

All rights are strictly reserved. No part of this document may be reproduced, modified, or transmitted in any form by any means, nor may it be stored in a retrieval system other than for the purpose to act as an aid in operating the equipment to which the document relates, without the prior written permission of Eurotherm limited.

Eurotherm Limited pursues a policy of continuous development and product improvement. The specifications in this document may therefore be changed without notice. The information in this document is given in good faith, but is intended for guidance only. Eurotherm Limited will accept no responsibility for any losses arising from errors in this document.

