



## W 1.2738 mod "E"

**2738 mod "E", is a prehardened 290–330 HB steel, grade specially designed for plastic mold industry.**

Chromium, molybdenum, manganese, Nickel additions are optimized to have a fully martensite-bainite microstructure after quenching. The steel is melted in an electrical furnace and refined with VOD or DH device. The cleanliness of the steel is guaranteed as well as the soundness. This makes the steel particularly well adapted for mold steel even when polishing or chemical etching are required for surface finish quality.

### Typical applications for 2738 mod «E» grade are:

- > Thermoplastics (PE, PP, PS), thermosetting plastics, transparent melts.
- > Plastic injection molds for thermoplastics.
- > Extrusion dies for thermoplastics
- > Compression molds.

### STANDARD

- > EN                      aprox. 40CrMnMo7+Ni
- > WERKSTOFF        aprox. 1.2738
- > AISI                    ≈ P20
- > AFNOR                aprox. 40CMND8

### PROPERTIES

### CHEMICAL ANALYSIS - WEIGHT%

|         | C    | Mo   | Ni   | Si   | Mn   | Cr   | S      | P      | B |
|---------|------|------|------|------|------|------|--------|--------|---|
| Mini    | 0.35 | 0.15 | 0.4  | 0.20 | 1.30 | 1.8  | -      | -      | - |
| Typical | 0.40 | 0.20 | 0.50 | 0.30 | 1.50 | 1.90 | <0.005 | <0.012 | + |
| Max     | 0.45 | 0.25 | 0.60 | 0.40 | 1.60 | 2.10 | -      | -      | - |

### PHYSICAL PROPERTIES

| Hardness range | Thermal conductivity<br>(W m <sup>-1</sup> K <sup>-1</sup> ) | Thermal expansion coefficient<br>(10 <sup>-6</sup> °C <sup>-1</sup> /10 <sup>-6</sup> °K <sup>-1</sup> ) |          |          |
|----------------|--|--|----------|----------|
|                |  | 20-100°C   | 20-200°C | 20-300°C |
| 280 - 325 HB   | 20°C (68°F)  | 11.5   | 11.57    | 12.47    |
| Min 270        | 34   | 11.5   | 11.57    | 12.47    |

### MECHANICAL PROPERTIES

**Internal soundness:** all plates are ultrasonically tested. The acceptance standards of ASTM A5 78.96.S9 are guaranteed. Grain size: uniform 7/8 grain according to ASTM E112.

**Cleanliness:** 2738 mod "E" is melted in an electric arc furnace and refined through a VOD or DH process—consequently, the content of non metallic inclusions is reduced to an extremely low level. This ensures a good polishability and chemical texturing ability and laser engraving.

Non metallic inclusions content is assessed in accordance with ASTM E45 Method A ("worst field").

2738 mod «E» has a very good hardenability resulting in good uniformity of hardness and microstructure

### Metallurgical transformation points

| AC <sub>1</sub> °C | AC <sub>3</sub> °C | M <sub>s</sub> °C | V <sub>1</sub> °C | V <sub>2</sub> °C |
|--------------------|--------------------|-------------------|-------------------|-------------------|
| 733                | 780                | 320               | 1000              | 300               |

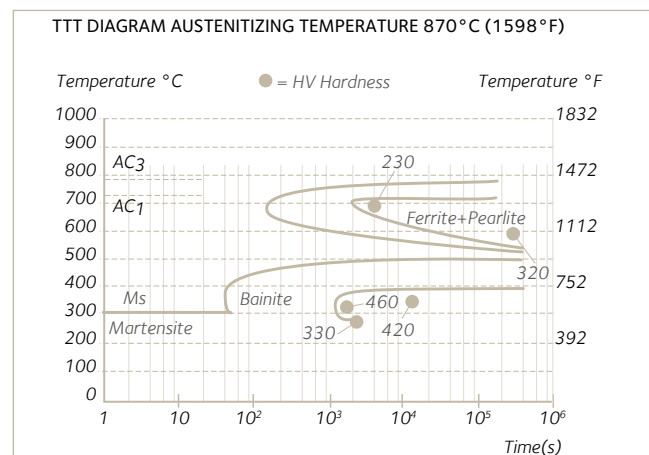
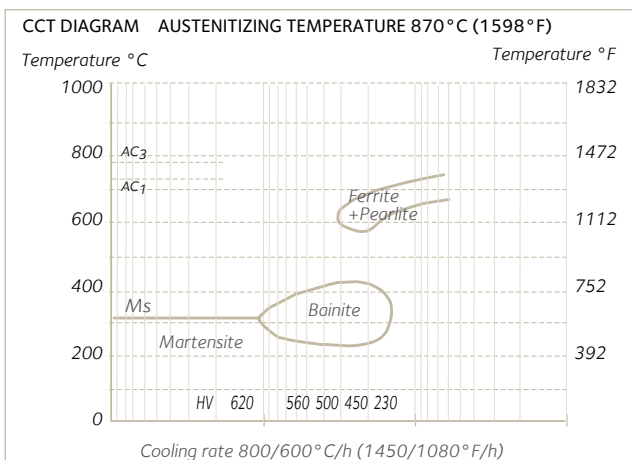
### PLATE PROCESSING

#### Homogeneity

2738 mod "E" has an excellent hardenability resulting in very good uniformity of hardness and microstructure. A maximum spread of 40 Brinell is obtained from surface to the center in any position of the block which guarantees a uniform hardness and structure in all directions.

CCT Diagram

TTT Diagram

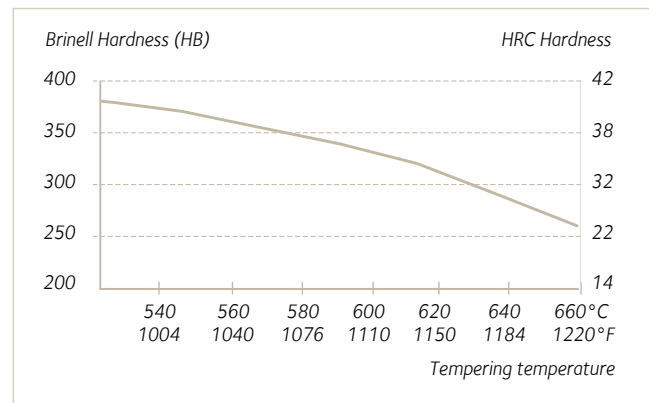


#### HEAT TREATMENTS

For specific applications where mechanical properties are different than 290 - 330 HB, hardening can be performed in the following way:

- Heating about 875°C with a sufficient holding time 1 hour/25mm of thickness
- Water, oil or air quenching depending on thickness (see C.C.T diagram)

the tempering temperature controls the mechanical characteristics. Generally, instructions given here after must be followed to obtain an efficient tempering: - Uniform heating at the selected tempering temperature (see tempering curve), Double tempering with complete cooling to room temperature for each treatment



Note that complicated shapes require accurate control of steel temperature uniformity and sufficient holding times to limit stresses and prevent cracking.

#### SURFACE TREATMENT

The quality of surface treatments depends widely on the surface roughness and characteristics after polishing. Homogeneity of hardness, microstructure and good cleanliness ensure a good behaviour for chromium plating, nickel plating or nitriding.

Nevertheless, after hard-chromium plating, the steel should be tempered for about 4 hours at 180°C (356° F) to avoid any hydrogen embrittlement.

## MACHINING

2738 mod "E" grade performs very well in drilling and in milling using high speed steel or carbide tools. Cutting conditions (cutting speed, feed rate, etc ) on machining conditions can be provided on demand.

## POLISHING

2738 mod «E» has a good polishability in quenched and tempered condition. After grinding, polishing shall be made with aluminium oxide or diamond paste.

A typical polishing sequence could be:

|          | Emery polishing paper or stones                                       | Diamond paste          |
|----------|---|------------------------|
| Grinding | FEPA 120 → 240 → 320 → 600 → 1000<br>GRIT 120 → 220 → 280 → 360 → 500 | 10µm → 6µm → 3µm → 1µm |

## TEXTURING

2738 mod "E" is particularly suitable for texturing. Steel making process and heat treatment of plate leads to uniform structure and homogeneous hardness which ensure accurate and consistent pattern reproduction.

## WELDING

Carefully degrease, clean and dry the surface before welding; grind surface defects is necessary. A V - type bevel without sharp angle is recommended. Pre and postheating treatment must be achieved to ensure crack free welds. Laser welding or GTAW are the recommended process to ensure a clean weld without sulphides, porosities or oxides which affect properties of the weld such as chemical etching ability, polishability... Industeel has developed a specific procedure to limit the risks of cracking and improve the response of the welded area to polishing and etching.

## DELIVERY CONDITIONS

### DIMENSIONAL PROGRAM

| Thickness           | Width             |
|---------------------|-------------------|
| 160 mm up to 610 mm | 2 000 or 1 600 mm |

## YOUR CONTACTS

**Perrine Lavalley**  
 Tel. +33 6 28 72 05 28  
[perrine.lavalley@arcelormittal.com](mailto:perrine.lavalley@arcelormittal.com)

<https://industeel.arcelormittal.com>

**Industeel France**  
 Le Creusot Plant  
 56 rue Clemenceau  
 F - 71 201 Le Creusot Cedex

*Technical data and information are to the best of our knowledge at the time of printing. However, they may be subject to some slight variations due to our ongoing research programme on steels. Therefore, we suggest that information be verified at time of enquiry or order. Furthermore, in service, real conditions are specific for each application. The data presented here are only for the purpose of description, and considered as guarantees when written formal approval has been delivered by our company. Further information may be obtained from the address opposite.*