Surface defects on steel materials No. 3.05

Scope
This Guidance Note describes the requirements for surface condition of steel materials, as delivered from the supplier. Pitting due to rusting is covered in GN 8.01.

General
Steel supplied from the mills will have been visibly inspected and any repairs carried out (where allowed) before delivery. Material with unrepairable defects will have been rejected. However, the steel is not usually blast cleaned, and still has mill scale adhering to it. Consequently, the surface that is revealed after grit/shot blasting may show surface discontinuities that were not visible before.

The requirements relating to surface condition of hot rolled steel products are given in EN 10163 (Ref 1). That Standard refers to 'imperfections' (discontinuities that may be left without repair) and to 'defects' (that shall be repaired). Repair procedures are covered. The Standard explains that discontinuities could include: rolled-in scale; pitting; indentations and roll marks (depressions and protuberances due to roll wear); scratches and grooves; spills and slivers (elongated flake-like discontinuities); blisters; sand patches; cracks; shells (overlapping material with non-metallic inclusions); and seams (elongated defects). Some of these discontinuities are rarely seen in steel produced by modern processes.

There is good reason to discover any surface discontinuities early in the fabrication process, since unacceptable or unrepairable defects may result in the rejection of a completed fabrication (with all the associated cost implications). A prefabrication blast will usually reveal all those that are likely to be unacceptable.

In EN 10163 a number of classes and subclasses are defined. The specifier can select a requirement class appropriate to the intended use of the material.

Imperfections and defects
Four classes of surface condition are defined, two for plates and wide flats, two for sections. For each class, small imperfections (up to specified limits) are acceptable. Larger imperfections (and extensive small imperfections) are considered to be defects and must be repaired, but there are limits to the remaining thickness under the defect.

The four classes of surface condition are:
Class A (plates)
Shallow depth imperfections, other than cracks, shell and seams, are acceptable; defects, including cracks shell and seams, must be repaired.

Class B (plates)
Similar to class A, except that the remaining thickness under any imperfection or defect may not be less than the minimum thickness allowed by the thickness tolerance standard (EN 10029) (Ref 2).

Class C (sections)
Modest depth imperfections (up to 3 mm deep in thick sections), are acceptable; deeper defects must be repaired.

Class D (sections)
Shallow depth imperfections (less deep than the limits in class C) are acceptable; deeper defects must be repaired.

Limiting depths relating to these classes are given in EN 10163.

Repair of defects
Three subclasses of surface condition specify how defects may be repaired.

Subclass 1
Repair by chipping and/or grinding followed by welding is permitted.

Subclass 2
Repair by chipping and/or grinding followed by welding is permitted only if agreed at the time of order.

Subclass 3
Repair by welding is not allowed

Surface conditions for bridge steelwork
It is generally considered that for bridge steelwork, repair of material by welding is not acceptable, because there would be no control over the final location of any repairs (and probably no record either); such repairs could therefore end up in fatigue-prone zones and result in premature failure. Subclass 3 should therefore be specified for both plates and sections.

For plates, class A permits imperfections that have a remaining thickness less than the

minimum tolerance value, provided that these are over a small proportion of the surface, whereas class B prohibits all imperfections that are deeper than the minimum tolerance value. It is generally accepted that class A3 is adequate for bridge steelwork.

For sections, class C accepts deeper imperfections than class D. In class D shallower imperfections would be considered defects and would have to be repaired. It is generally considered that class C3 is adequate for bridge steelwork.

The requirement for compliance with classes A3 and C3 is included in the *Model project specification* document (Ref 3).

When subclass 3 is specified, repair of an unacceptable defect by welding is not allowed, as stated above. If such a defect is revealed only after the material has been incorporated into a fabricated assembly, the question is likely to arise as to whether it can be repaired. Strictly, the material as supplied did not comply with the specified requirements and can be rejected, but it is open to the purchaser to judge the situation on its merits, considering the fitness for purpose of a repaired component.

References

1. EN 10163, Delivery requirements for surface condition of hot rolled steel plates, wide flats and sections.
   Part 1: 2004, General requirements.
   Part 2: 2004, Plates and wide flats.
   Part 3: 2004, Sections.
2. EN 10029: 1991, Specification for tolerances on dimensions, shape and mass for hot rolled steel plates 3 mm thick or above.
3. Model project specification for the execution of steelwork in bridge structures (P382), SCI, 2008.