


HANDLING ON INTERLEAF
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 SPECIFICATION	STEEL SCREWS Screws' I and II qualitative level of surface defects		18-0505 Enclosure 6
			Page 1/13 Date 11.05.2004
<p>Supervisor: M. Revellino – P. & B.S. – T.S.C. – Mat. Testing Labs – telephone (0039) 011.00.75787</p> <p>Manager: F. Cottino – P. & B.S. – T.S.C. – Mat. Testing Labs – telephone (0039) 011.00.75791</p> <p>NOTE: <i>The present standard is partly in agreement with ISO/DISstandard 6157/1 and 3 (1988), and with UNI standard 3740 Part 10 (1982).</i></p> <div style="border: 1px solid black; padding: 10px; text-align: center; margin: 20px 0;"> <p>This Standard replaces IVECO STD. 18-0505 Part 7 ed. 2 dated 05.06.1987.</p> </div> <p>1 SUBJECT AND VALIDITY</p> <p>1.1 According to the conditions of validity defined in detail in IVECO STD. 18-0505, this standard establishes the limits allowed for the different types of surface defects on screws and studs (specified in the title, and on the screws listed below) having:</p> <ul style="list-style-type: none"> – thread diameter between 5 – 39 mm; – A and B – category; – 1st and 2nd quality level (see IVECO STD. 18-0505 Enclosure 10), i.e.: strength classes 8.8, 10.9, 12.9, 10R and 12R. <p>1.2 Possible further requirements will be reported either on drawings or in the product's standard.</p> <p>If specifications for endurance strength are given, this should not be less than that found on defect-free screw taken from the same stock.</p> <p>NOTE:</p> <ul style="list-style-type: none"> – <i>The diagrams in point 2.1.1 are simply indicative examples, which can be applied to other similar types of screws.</i> – <i>Each diagram sometimes shows exaggerated surface defects to give a clearer explanation.</i> – <i>On page 12 there is a table recapitulating the limit values of surface defects allowed on screws.</i> 			
Edition	Date	Description of modifications	Group
1	25.07.1985		CFO
2	05.06.1987	Editorial mistakes corrected.	
3	11.05.2004	Completely revised for updating. It was 18-0505 Part 7.	
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2 TYPES OF DEFECTS (DESCRIPTION, APPEARANCE AND LIMITS)

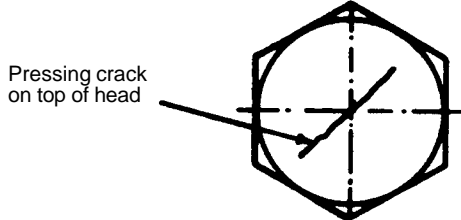
2.1 Cracks

A crack is a clear-cut fracture which crosses or follows the edge of the crystalline grain and can be caused by the inclusion of foreign bodies. Cracks are generally caused by excessive strain of the metal during pressing or other forming operations, or during the heat treatment stage. Cracks are usually clearly outlined by zinc silicate, when the screw is subjected to considerable heating.

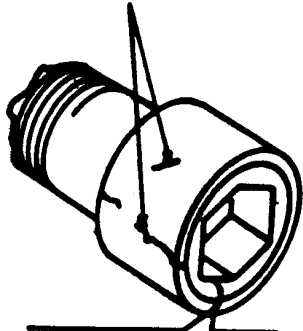
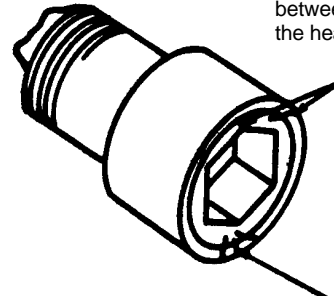
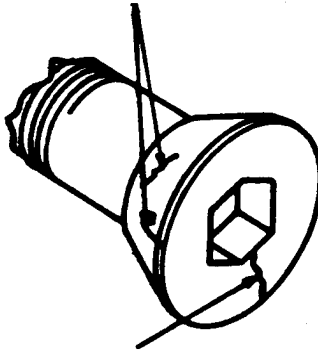
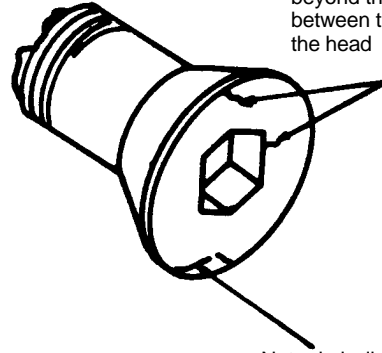
2.1.1 Hardening cracks

Description	Hardening cracks can form during heat treatment because of excessive strains. Hardening cracks usually have an irregular and undefined course along the surface of the screw, and a variable depth. They can also be caused by pre-existing defects in the material and in this case they will have a straight course.
Appearance	
Limits	Hardening cracks of any dimension and at any point of the screw are not admissible.

2.1.2 Compression cracks

Description	Compression cracks can form during material cropping and forming and concentrate on head top or screw end.
Appearance	
Limits	To be admissible, compression cracks on the head of the screw must be $\leq 1 d$ in length; and $\leq 0.04 d$ wide and deep. For socket-head screws see, 2.1.3 $d =$ nominal thread diameter.

2.1.3 Compression cracks on socket head screws

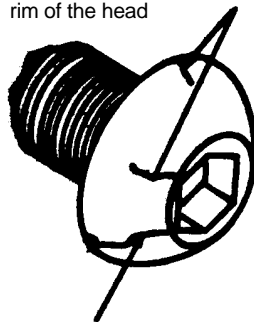
Description	Compression cracks can form on rims, head surfaces, on the walls of the recessed hexagon, or on internal or external faces, due to cropping of the material or to shearing or compression strains that occur during pressing operations on the head.
Appearance	<div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> <p style="text-align: center;">Admissible</p>  <p style="text-align: center;">Not admissible: When it crosses the wall thickness between the slot and the external surface of the head</p> </div> <div style="width: 50%;"> <p style="text-align: center;">Admissible: but must not extend beyond the half of the distance between the external surface of the head and the slot</p>  <p style="text-align: center;">Not admissible: possibility of intersection of cracks</p> </div> <div style="width: 50%;"> <p style="text-align: center;">Admissible</p>  <p style="text-align: center;">Not admissible: cracks that cross the whole surface between the slot and the rim of the head</p> </div> <div style="width: 50%;"> <p style="text-align: center;">Admissible: but must not extend beyond the half of the distance between the slot and the rim of the head</p>  <p style="text-align: center;">Not admissible: possibility of intersection of cracks</p> </div> </div>

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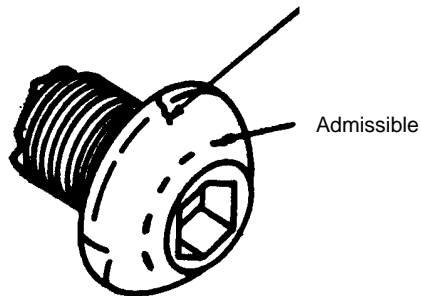
(continued)

Appearance

Admissible: but must not extend beyond the half of the distance between the slot and the rim of the head

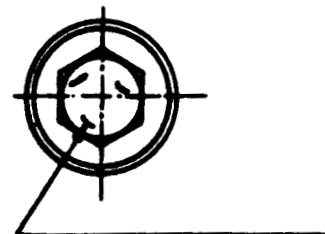
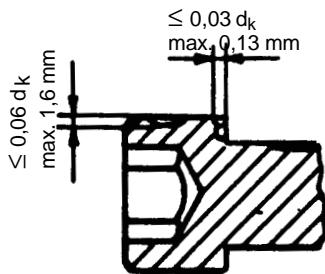


Admissible in the cylindrical area on the rim of the head

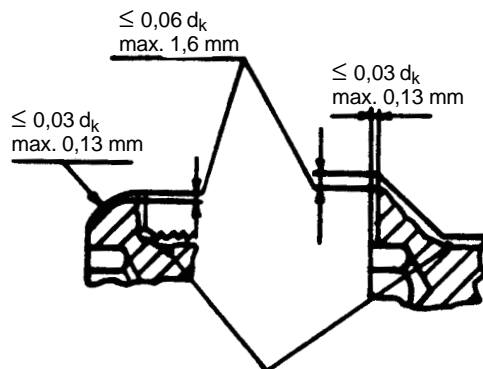


Not admissible: cracks that cross the whole surface between the slot and the rim of the head

Not admissible: possibility of intersection of cracks



Admissible at the bottom of the slot (not in the area which connects with the wrench)

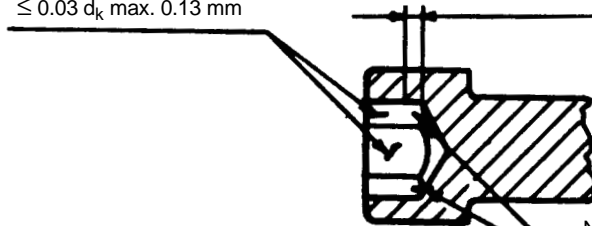


Not admissible in a transverse direction



Admissible:
if length is
≤ 0.25 t and depth
≤ 0.03 dk max. 0.13 mm

0.3 t – Cracks in this area are not admissible



Not admissible: in the area between the bottom of the slot and 0.3 t from the bottom

(continues)

(☞ continued)

Limits	<p>Pressing cracks that extend from the hexagonal slot to the surface of the head and cracks originating from the external surface of the head that extend transversely until they intersect, are not admissible.</p> <p>Cracks placed in the hexagonal slot in the area between the bottom of the slot and 0,3 t above this, are not admissible; however, cracks in the slot outside this area are admissible provided that they measure $\leq 0,25 t$ in length and $\leq 0,03 d_k$ (max. 0,13 mm) in depth.</p> <p>A single crack, in a longitudinal direction, is admissible in the shank-head connection area, provided that it measures $\leq 0,03 d_k$ (max. 0.13 mm) in depth.</p> <p>Longitudinal cracks on the outside surface of the head are admissible if they measure $\leq 0.06 d_k$ (max. 1.6 mm).</p> <p style="text-align: center;">d_k = head diameter ; t = slot depth.</p>
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2.2 Fissures

Fissures are cracks that have opened on the material's surface.

2.2.1 Compression fissures

Description	<p>Compression fissures can develop on the driving surfaces, on the intersecting corners between the driving surfaces of the head, on the external surface of the flanged or circular-headed screw, or on the edge of the recess in the head.</p>
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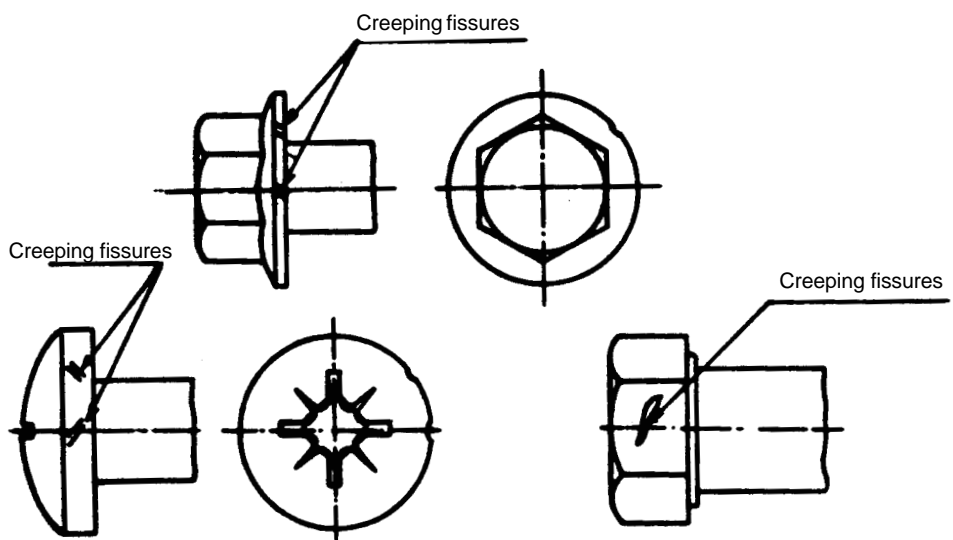
Appearance	<p>The image contains eight technical drawings of screw heads, arranged in two rows of four. Each drawing shows a different view of a screw head with a hexagonal slot. Labels 'Compression fissure' with arrows point to specific locations where cracks can occur: on the driving surfaces, at the corners of the head, on the external surface of the flanged or circular-headed screw, and on the edge of the recess in the head.</p>
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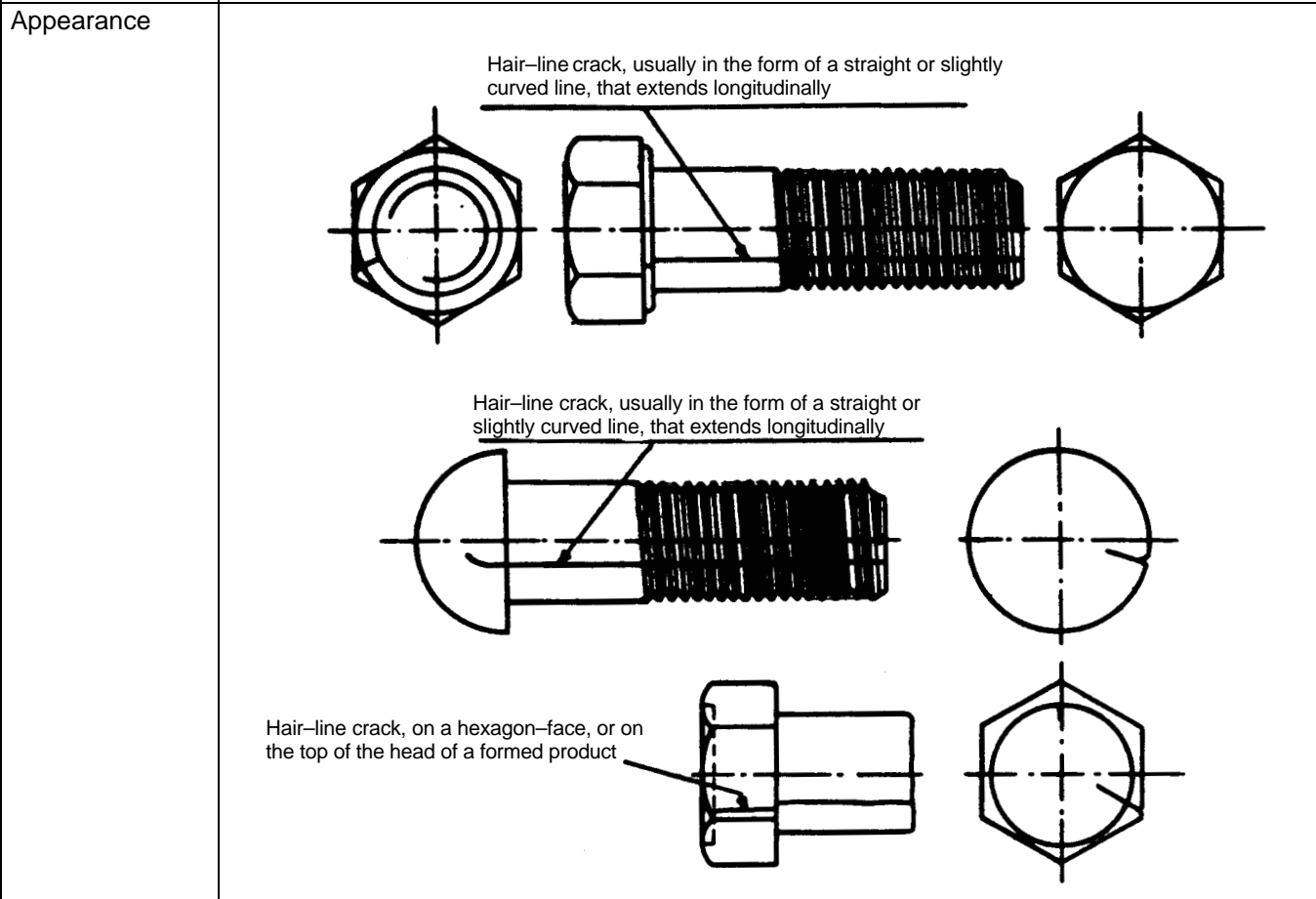
Limits	<p>HEXAGON-HEAD SCREWS No fissure on the driving surface of the hexagon-head screw must extend to the circular area on the head top (the circle that surrounds the bevel), or to the supporting face under the head. Fissures that form on the intersecting corners between driving surfaces, must not reduce the corner width dimensions below the minimum limit. To be admissible fissures must have:</p> <p>Width: $\leq 0.25 \text{ mm} + 0.02 \text{ s}$ (for driving surfaces) Depth: $\leq 0.04 \text{ d}$</p> <p>CIRCULAR-HEADED SCREWS Flanges and rims of circular-headed screws can show fissures. Fissures are admissible in the following conditions:</p> <p>Width: $\leq 0.08 \text{ d}_c$ (for a single fissure) $\leq 0.04 \text{ d}_c$ (for two or more fissures, where only one can extend up to 0.08 d_c)</p> <p>Depth: $\leq 0.04 \text{ d}$ $\leq 0.06 \text{ d}$ for screws with sockets (fissure must not extend below the depth of the socket itself)</p> <p>For socket-head screws, the limits for compression cracks in 2.1.3 are valid d = nominal thread diameter; d_c = flange diameter s = wrench width</p>
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2.2.2 **Creeping fissures**

Description	Creeping fissures can form during stamping, especially on the rims of circular-headed or flanged screw and are generally at a 45° angle in relation to the axis of the screw. Creeping fissures can also form on the driving surfaces, on the intersecting corners between the driving surfaces and on the rim of the head recess.
Appearance	
Limits	<p>HEXAGON-HEAD SCREWS Width: $\leq 0.25 \text{ mm} + 0,02 \text{ s}$ (for driving surfaces) Depth: $\leq 0.04 \text{ d}$</p> <p>No creeping fissures on the driving surface of the screw must extend to the circular area on the head top (the circle surrounding the bevel), or to the supporting face under the head. Creeping fissures that form on the intersecting corners between driving surface must not reduce the corner width dimensions below the minimum limit.</p> <p>CIRCULAR-HEADED SCREWS The flanges of screws, and the external surfaces of circular-headed screws can show creeping fissures, which are admissible under the following conditions.</p> <p>Width: $\leq 0.08 \text{ d}_c$ (for a single fissure in the case of flanged and circular-headed screws) $\leq 0.04 \text{ d}_c$ (with two or more fissures, where only one can extend up to 0.08 d_c for flanged and circular-headed screws)</p> <p>Depth: $\leq 0,04 \text{ d}$ $\leq 0,06 \text{ d}$ for screws with a recess (fissure must not extend below the depth of the recess itself).</p> <p>For cylindrical socket-head screws, the limits shown in 2.1.3 are valid. d = nominal thread diameter d_c = diameter of the flange s = wrench width</p>

2.3 Hair-line cracks or scorings

Description Hair-line cracks or scorings appear as general straight or slightly curved narrow lines and they run longitudinally to the axis of the screw.
Hair-line cracks or scorings can extend from the shank end to the periphery, or to the head top.
Hair-line cracks or scorings generally derive from the original material (in its rolling or drawing stages) or from toolwork during pressing. They can also cause compression fissure.



Limits To be admissible, hair-line cracks or scorings on the screw's shank must not have a depth higher than:

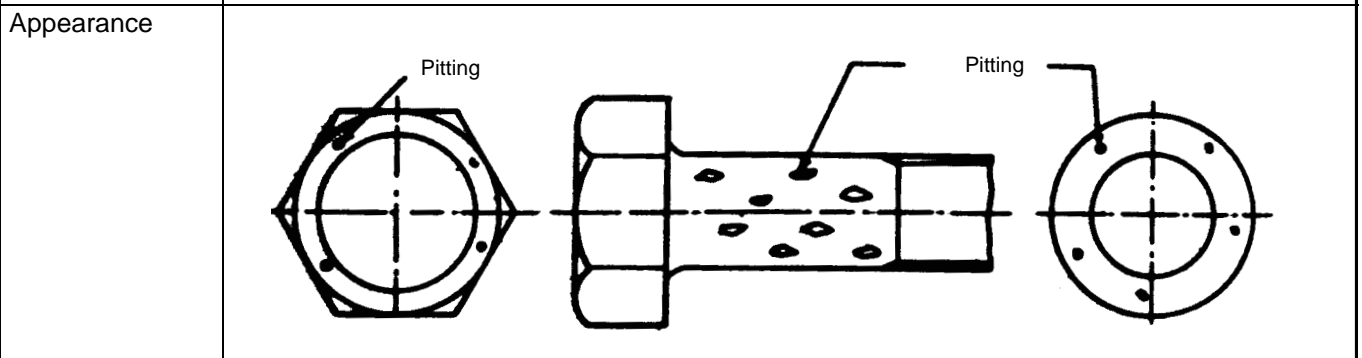
$0.15 d + 0.1 \text{ mm (max. } 0.4 \text{ mm)}$

Hair-line cracks or scorings that extend to driving surfaces or on the flange are admissible within the limits specified for fissures (see point 2.2).

NOTE: *In case of screws with thread formed by turning, hair-line cracks or scorings in a longitudinal direction must not affect the threaded part.*
d = nominal thread diameter.

2.4 **Pitting**

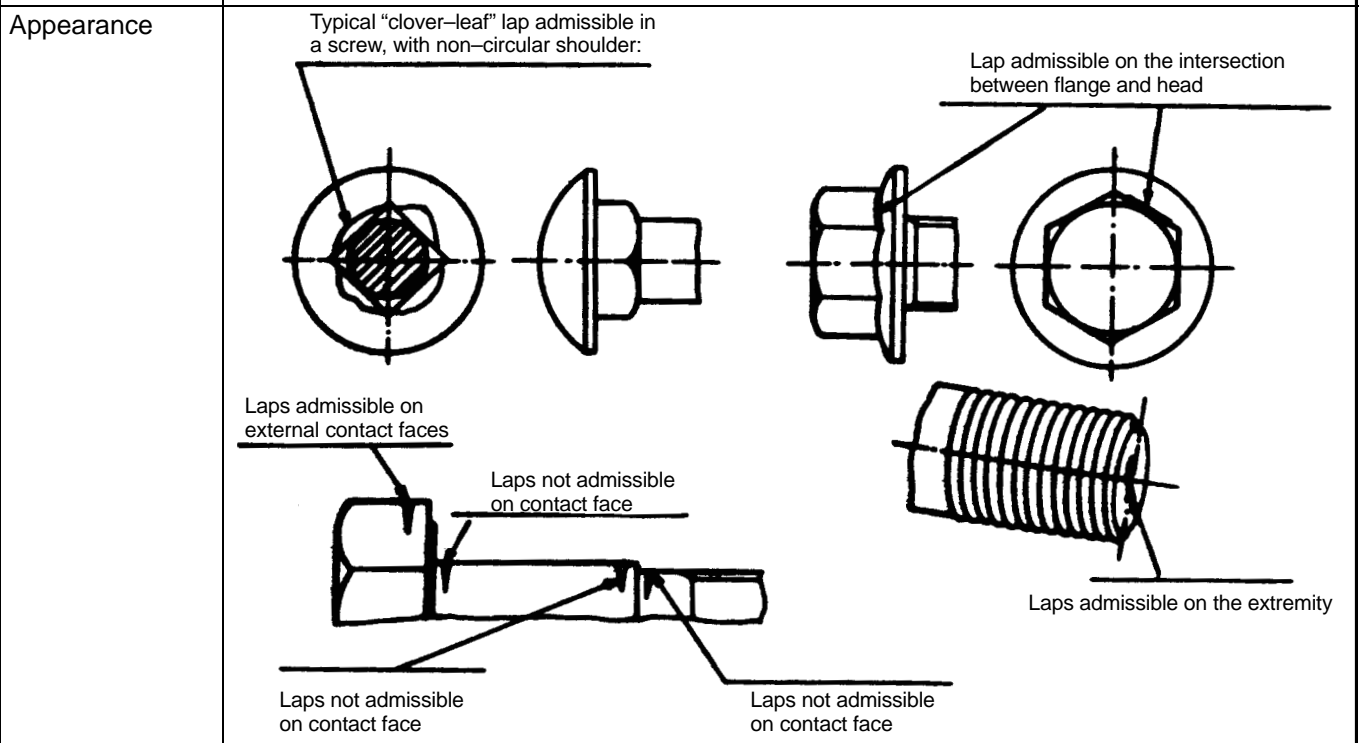
Description Pitting consists of shallow cavities on the screw's surface, caused by non-filling of the metal during either pressing or upsetting.
Pitting can originate from imprints of metal particles (burrs, swarf, etc.) or from cavities due to rusting or pickling on original material.



Limits To be admissible, pitting on the supporting surfaces of the head must have a depth of:
 $\leq 0.02 d$ (max. 0.25 mm) and extend over an area
 $\leq 5\%$ of the area of the supporting surface of the head
 $d =$ nominal thread diameter

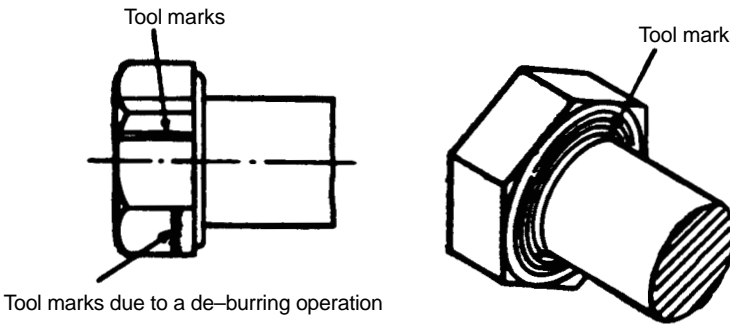
2.5 **Laps**

Description Laps are super-impositions of material on the surface of the screw, due to insufficient congruence between shape and volume at each stage of stress during pressing.
They can form near, or on an intersection, corresponding to a variation in diameter, and they are especially prevalent on the underneath of the head and shoulder.

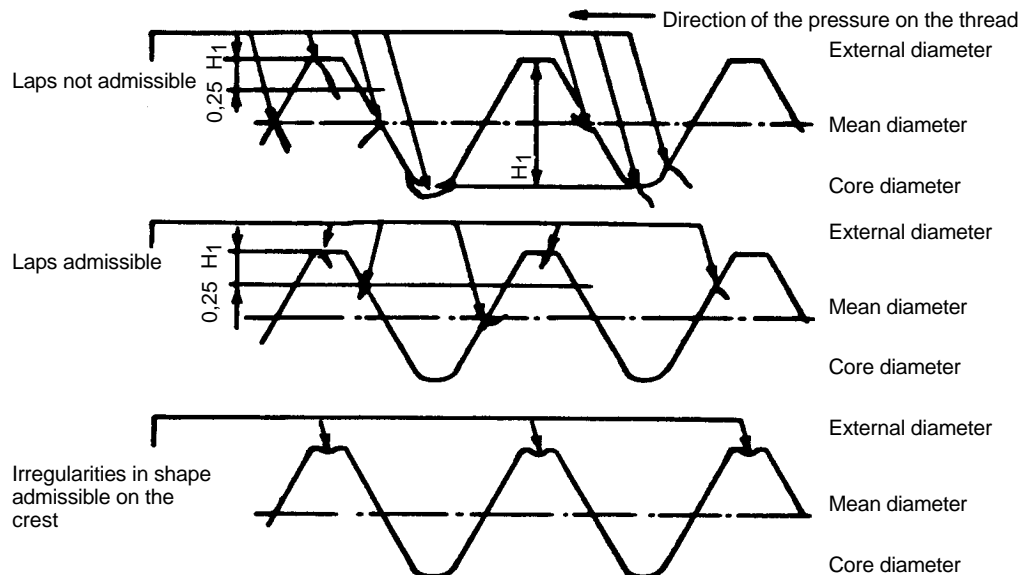


Limits Laps on contact faces of supporting surfaces underneath the head or shoulder, with the exception of intersections between flange and head, are not admissible.
Laps on contact faces and on the extremity are admissible.

2.6 Tool marks

Description	Tool marks are slightly deep scorings caused by the action of machine tools on the screw surface. They are generally in a longitudinal or circular direction.
Appearance	
Limits	To be admissible, tool marks on the supporting face must not extend to the contact face area between head and shank, and must not cause a roughness R_a , greater than $3.2 \mu\text{m}$ (see IVECO STD. 10-2603).

2.7 Laps on thread

Description	Laps on thread are super-impositions of material that develop during forming by cold-rolling of threads.
Appearance	
Limits	<p>Laps of any length or depth are not admissible if they appear:</p> <ul style="list-style-type: none"> - on the thread root; - on the side of the thread under pressure below the mean diameter, even if starting above the mean diameter; - free side of the thread, starting below the mean diameter, if it is directed towards the thread root. <p>Laps, provided that they are $\leq 0,25 H_1$ in depth, are admissible if they appear:</p> <ul style="list-style-type: none"> - starting on the crest of the thread; - on the sides under pressure, and not starting above the mean diameter, provided that they do not cross the mean diameter or exceed the maximum circumferential length by half a turn; - on side pressure-free side of the thread, by starting below the mean diameter, provided that they point towards the external diameter. <p>An irregularity of shape on the thread crest due to non-filling by the material during rolling is admissible.</p> <p>H_1 = Thread height.</p>

2.8 **Dents and cuts**

Description	Dents and cuts are small strains and local irregularities on the surfaces due to rubbing or impact.
Appearance	They are shapeless, without defined positions and directions; they originate from external process during manufacture, handling and transportation.
Limits	<p>Dents and cuts cannot be avoided, but are admissible if they do not impair the operation or use of the screw.</p> <p>They are admissible on the thread if their dimensions and number are such that it is possible to screw the ring-thread go gauge, by applying a torque, expressed in Newtons per metre, of no higher than $0.001 d^3$.</p> <p>NOTE: <i>To reduce dents and cuts in transit, agreements can be made by the purchaser and the supplier, for packaging standards.</i></p> <p><i>d = nominal thread diameter.</i></p>

TABLE RECAPITULATING LIMIT VALUES (in mm) OF SURFACE DEFECTS ADMISSIBLE ON SCREWS

Reference		2.1.2		2.1.3				2.2.1			2.2.2		2.3	2.4	2.7	2.8	
Type of defects		Compression cracks		Compression cracks on socket head screws				Compression fissures			Creeping fissures		Hair-line or scorings	Pittings	Laps on the thread	Dents and engravings on thread	
Mean diameter and pitch of thread		Length	Width or depth	In the slot above at 0.3 t from shank		In the connection and support side	In the cylindrical shell	Width	Depth		Width	Depth		Depth	Depth	Depth	Moment
d	P	max.	max.	Length	Depth	Depth	Depth	max.	0.04 d	for screws with impression 0.06 d	max.	0.04 d	for screws with impression 0.06 d	max.	max.	0.25 H ₁	N·m
				max.	max.	max.	max.		max.	max.		max.	max.	max.	max.	max.	max.
5	0.8	5	0.20	0.25 x depth of slot (t)	0.03 head depth (d _h) max. 0.13 mm	0.03 head diameter (d _h) max. 0.13 mm	0.06 head diameter (d _h) max. 0.16 mm	0.25 mm + 0.02 s for hexagonal heads 0.08 d _c for single fissure for cylindrical and flanged heads 0.04 d _c for single fissures for cylindrical and flanged heads	0.20	0.30	0.25 mm + 0.02 s for hexagonal heads 0.08 d _c for single fissure for cylindrical and flanged heads 0.04 d _c for single fissures for cylindrical and flanged heads	0.20	0.30	0.17	0.10	0.11	0.125
6	1	6	0.24						0.24	0.36		0.22					
8	1.25	8	0.32						0.32	0.48		0.17					
10	1.5	10	0.40						0.40	0.60		0.12					
12	1.75	12	0.48						0.48	0.72		0.14					
14	2	14	0.56						0.56	0.84		0.16					
16	2	16	0.64						0.64	0.96		0.17					
18	2.5	18	0.72						0.72	1.08		0.20					
20	2.5	20	0.80						0.80	1.20		0.24					
22	2.5	22	0.88						0.88	1.32		0.25					
24	3	24	0.96						0.96	1.44		0.27					
27	3	27	1.10						1.10	1.62		0.27					
30	3.5	30	1.20						1.20	1.80		0.34					
33	3.5	33	1.30						1.30	1.98		0.34					
36	4	36	1.40						1.40	2.16		0.41					
39	4	39	1.60						1.60	2.34		0.41					

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3 INSPECTION

To establish the acceptability of stock on the merits of admissible surface defects, a sample must be withdrawn, and it must be checked that the maximum number admissible of parts not in conformance, is not exceeded, as set out in IVECO STD. [18-0505 Enclosure 10](#).

Any protective coatings must be removed before checking.

The sample can be checked visually, and if necessary, by magnetic inspection, or by similar non-destructive techniques, provided that they are sufficient to show up surface defects.

In the course of examining parts to check the thread, special attention must be paid to transverse cracks, or to laps on internal angles which cannot be found by a single visual examination.

Parts which show signs that can be interpreted as hair-line cracks, must be cross-sectioned at right-angles to the axis, pickled, and then subjected to a microscopic test.

The section must be placed in the non-threaded part at the end of the uncomplete thread.

For screws with complete threads, the sectioning must be carried out where the threading seems to cut the thread bottom at a distance more or less equal to d , starting from the surface under the head.

STANDARDS QUOTED:

IVECO STD.: 10-2603, 18-0505, 18-0505 Enclosure 10.