European Common Criteria for Maintenance (ECCM) of freight wagon axles

to be applied **in wheelset axle maintenance**

Joint Sector Group for ERA Task Force on wagon/axle maintenance
Lille
22nd June 2010

The Task Force results will be anchored in a consistent standard's architecture

Amendments / clarification for new built material

Standards for new built wheelsets (EN 13103 etc.)

Standard for wheelset maintenance (EN 15313*)
National standards (e.g. DIN 27204, NF…), enterprise's standards
GCU

Minimum Acceptance Criteria in operation and light maintenance

Outer state: EVIC
Inner state: current results from NDT in heavy maintenance

Bad axles sorted out quickly

Common Criteria for Maintenance (ECCM) in heavy maintenance

examples

which NDT and where,
axle surface status to be treated,
special regimes
traceability,....

Axle maintenance quality improved further

* special reference to freight axles to be made

- **ECCM summary of the results**
- **ECCM decisions to be taken outside the ERA Task Force**

ECCM results summary (1)

EU-wide harmonised requirements for…

Light Wagon Maintenance

- Visual checks of the axle surface (EU-harmonised) according EVIC catalogue
- Corrosive environments: EVIC „short“ (4y) and more severe EVIC criteria (only cases A, B)

Heavy Wagon Maintenance (revision, major overhaul)

- Remove all axles with EVIC defect cases A, B, handover to wheelset maintenance (medium or heavy)
- Remove all axles with EVIC defect cases C (replace or repair)

Higher axle maintenance levels (1)

- **Axle surface status**
  - Treatment of local and severe defects (according UIC category 4)
  - Treatment of large and heavily corroded areas, strongly and uniformly pitted surface
- **Non-Destructive Testing (NDT)**
  - Complete NDT on all axle sections in the „medium maintenance“ level (off-vehicle maintenance level w/o changing wheels). Required migration is ongoing
  - Complete MT on the total axle surface in the highest maintenance level

ECCM results summary (2)

EU-wide harmonised requirements for…

Higher axle maintenance levels (2)

- **Wear limits**
  - Min. wheel seat diameter (all UIC Type A axles) limited to 182 mm when operated at 20t

Operation

- Unified rules for high performance axle operation (all UIC axle types)
- Continued operation of painted and unpainted axles under today‘s existing service and appropriate maintenance conditions (including Task Force results)

Traceability

- European EVIC logging
- European Wheelset Traceability + measures resulting from lack of traceability

ECCM decisions that require further investigations and that can only be taken outside/after the ERA Task Force

Topic	ongoing work in	results
• Final results on inadmissible “UIC surface roughnesses” in maintenance levels	UIC project	2011
• Handling of painted / unpainted situation	EURAXLES	2014
• Need for Harmonisation of NDT techniques?	EURAXLES	2014
• Effects on WS/axles caused by special events (derailments etc.)	investigation project	started by JSG

1.1 Light wagon maintenance level

Light wagon maintenance: activities

LM Light Maintenance	AAE	SNCF	SNCB	DBSR D	DBSR UK	SBB	ÖBB	UIP	TI	PK P	SLO -SZ
Visual checks in light maint. according GCU criteria	yes	Yes	yes	yes	Yes (acc. to UK NTR – fully meets EVIC and requires more)	yes	yes	yes	yes	yes	yes
Visual checks of the axle surface in light wagon maintenance according EVIC catalogue	Yes New: European harmonised criteria										
Visual checks of the axle surface in light wagon maintenance according EVIC for corrosive conditions operation (salt, potash, fertilizers,..)	• EVIC „short“ (4 years) • more severe EVIC criteria (only cases A, B)										

Task Force result

Task Force result

1.2 Heavy wagon maintenance level (revision, major overhaul)

Heavy wagon maintenance level (revision, major overhaul): activities

HM Heavy Wagon Maintenance (revision, major overhaul)	AAE	SNCF	SNCB	DBSR D	DBSR UK	SBB	ÖBB	UIP	TI	PK P	SLO -SZ
Remove all axles with EVIC defect cases A, B and hand them over to wheelset maintenance (medium or heavy)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Remove all axles with EVIC defect cases C (replace or repair)	yes	yes	N.A.	yes	yes	yes	yes	yes	yes	yes	yes

Prescriptions to be inserted in all Freight Wagon Heavy Maintenance schemes (revision, major overhaul)

2. Reprofiling only level

Reprofiling only: activities

Reprofiling	AAE	SNCF	SNCB	DBSR D	DBSR UK	SBB	ÖBB	VPI	TI	PKP	SLO-SZ
Level name	IS 1	R	Repro filing	IS1	Repro-filing	IHS 1	IS1	IS1	on cond	Not exis ting	?
Max. Interval	depends on wheel wear										
Visual inspection free axle surface	yes	yes	yes	yes	yes	yes	yes	yes	yes		yes
Repair EVIC case C coating damages	yes	yes	N.A.	yes	yes	yes	yes	yes	yes		yes
If surface status under coating not clear: remove coating	yes	yes	N.A.	yes	rem. from serv. + overhaul	yes	yes	yes	yes		yes
Treat or withdraw axles with cracks or mechanical damage or corrosion	Yes	yes	yes	yes	rem. from serv. + overhaul	yes	yes	yes	yes		
Treat or withdraw axles with local and severe defects (according UIC category 4)	yes	yes	yes	yes	rem. from serv. + overhaul	yes	yes	yes	yes		yes

Task Force result

3. „Medium maintenance“ level
(without changing wheels, combined with bearing overhaul)

Medium Maintenance (w/o changing wheels): activities

MM Medium Maintenance	AAE	SNCF	SNCB	DBSR D	DBSR UK	SBB	ÖBB	VPI	TI	PKP	SLO-SZ
Level name	IS 2	COP	CA / GC	IS 2	N.A.	IHS 2 and 3	IS 2	IS 2	RI/RO	P 3	(IS 2)
Max. Interval - mileage - year	600 3-(6)-9	600 (13)-19	800 10/12y	660 7/ 12 /16	700 6/ 8/ 12	500 10-12 6/8IS1	12+1 avg 6,8		600 6	4=>6	5 - 6
All mileages/years based on bearing and grease criteria => level combined with bearing overhaul											
Visual inspection free axle surface	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Repair EVIC case C coating damages	yes	yes	N.A.	yes	yes	yes	yes	yes	yes	yes	yes
If surface status under coating not clear: remove coating as far as necessary	yes	yes	N.A.	yes	N.A.	yes	yes	yes	yes	yes	yes
Treat or withdraw axles with cracks or mechanical damage	yes	yes	yes	yes	N.A.	yes	yes	yes	yes	yes	
Treat or withdraw axles with local and severe defects (according UIC category 4)	yes	yes	yes	yes	N.A.	yes	yes	yes	yes	yes	
Treat or withdraw axles with large + heavily corroded areas, strongly+uniformly pitted surface	yes	yes	yes				yes	yes	yes	yes	

Task Force result

Task Force result

Not applied – controlled by (a) in-service maintenance, (b) reprofile or (c) overhaul

V1.1

Medium Maintenance (w/o changing wheels): NDT

Migration to full axle NDT inspection ongoing

MM Medium Maintenance	AAE	SNCF	SNCB	DBSR D	DBSR UK	SBE	ÖBB	VPI	TI	PKP	SLO-SZ
Level name	IS 2	COP	CA / GC	IS 2	NA/oper. WS OH to OH	IHS and	IS 2	IS 2	RI/RO	P 3	(IS2)
Seats	Auto or Man UT	Man UT	Man UT (inner sect)	Auto UT	N/A	Man (part	Auto UT	Man UT	Auto UT	Man UT	Man UT
Transition radii shaft - wheelseat	Auto or Man UT	MT	Man UT (inner sect) New: both sides	Auto UT	N/A	Man (inn sec	Auto UT	MT	Auto UT	Man UT	Man UT
shaft	Auto or Man UT	MT	New: MT	Auto UT	N/A		Auto UT	MT	Auto UT	Man UT	Man UT
Abutment	Auto or Man UT	MT	New: MT	Auto UT	N/A		Auto UT	MT	Auto UT	Man UT	Man UT
journal	Auto or Man UT	MT	New: MT	Auto UT	N/A	--	Auto UT	MT	Auto UT	Man UT	Man UT
Additional NDT	MT after treating defects + aft UT finding	MT	MT (loc) after treating defects	MT (loc) after treatg. defect	UT / MT / ECT in case of heavy corrosion	MT after UT finding	MT after treating defects + aft UT finding	MT	MT after treatg. corro:. Defs	MT if ne-ces-sary	Man MT
Repair painting system	yes	yes	N.A.	yes	yes	yes	yes	yes	yes	yes	yes

Task Force result

4. Heavy maintenance level (with changing the wheels)

Wheel wear with time back stop to cater for mileage operated between wheelset last test and bearing in-service operation

V1.1

Heavy Maintenance (with changing wheels): activities

HM Heavy maintenance	AAE	SNCF	SNCB	DBSR D	DBSR UK	SBB	ÖBB	VPI	TI	PKP	SLO-SZ
Level name	IS 3	CR 1-5	CG / AC	IS 3	Overhaul	IHS 4	IS 3	IS 3	RI/RO	P 4	(IS3)
No special interval, depends on wear of wheel	yes	yes	yes	yes		yes	yes	yes	yes	yes	yes
Visual inspection free axle surface	yes	yes	yes	yes	yes.	yes	yes	yes	yes	yes	yes
remove coating (MT related)	yes	yes	N.A.	yes	yes	yes	yes	yes	yes	yes	yes
Treat or withdraw axles with cracks or mechanical damage	yes	yes	yes	yes	Yes or scrap	yes	yes	yes	yes	yes	yes
Treat or withdraw axles with local and severe defects (according UIC category 4)	yes	yes	yes	yes	Yes or scrap	yes	yes	yes	yes	yes	Task Force result
Treat or withdraw axles with large + heavily corroded areas, strongly+uniformly pitted surface	yes	yes	yes	yes	Yes or scrap	yes	yes	yes	yes	yes	Task Force result
Treatment of wheelseats (turn or grind)	yes if nec	yes if nec	yes if nec	yes if nec	yes if nec	yes if nec	yes if nec	yes if nec	yes if nec	yes if ne	yes If nec
Treatment of shaft and transition radii (turn or grind)	yes if nec	yes if nec	yes if nec	yes if nec	yes if nec	yes If nec	yes if nec	yes if nec	yes if nec	yes if ne	yes
All type A axles operated at 20t	minimum wheel seat diameter 182 mm										Task Force result
Treatment of abutment	yes if nec	yes if nec	yes if nec	yes if nec	yes if nec	yes if nec	yes if nec	yes if nec	yes if nec	yes if ne	yes If nec

Heavy Maintenance (with changing wheels): NDT

HM Heavy Maintenance	AAE	SNCF	SNCB	DBSR D	DBSR UK	SBB	ÖBB	VPI	TI	PKP	SLO-SZ
Level name	IS 3	CR 1-5	CG / AC	IS 3	Overhaul	IHS 4	IS 3	IS 3	RI/RO	P 4	(IS3)
Seats	MT	MT	MT	MT	UT / MT / ECT	New: MT	MT	MT	MT	UT+ MT	MT
Transition radii shaft – wheelseat	MT	MT	MT	MT	UT / MT / ECT	New: MT	MT	MT	MT	UT+ MT	MT
Shaft	MT	MT	MT	MT	UT / MT / ECT	New: MT	MT	MT	MT	UT+ MT	MT
Abutment	MT	MT	MT	MT	UT / MT / ECT	New: MT	MT	MT	MT	UT+ MT	MT
Journal	MT	MT	MT	MT	UT / MT / ECT	New: MT	MT	MT	MT	UT+ MT	MT
Repair painting system	yes	yes	NA	yes	Yes (where required)	yes	yes	yes	yes	yes	yes

Task Force result

5. Special regimes

Continued high performance operation *(increased load limit)*

Swedish experience still to integrate

Limit for high performance operation		Limited mileage between medium or heavy maintenance (with and w/o changing wheels)	Corresponding maintenance Action
type A-I; A-II; A-III(1)	20 t	**> 20 t not permitted**	
Axle load exceeding design load <= 5% type A-III (2)	> 20,6 t up to 21 t	- 400.000 km - ECM task is to define the equivalent time limit	**NDT with mounted wheels** - UT at wheel seat - UT or MT at transition radii
Axle load exceeding design load >5% ->10% type A-III (2)	> 21 t up to 22 t	- 200.000 km - ECM task is to define the equivalent time limit	
For type A axles operated at 21t axle load in standard maintenance plan and re-classified back to 20t operation:		re-integrate axle in standard maintenance plan with UT of the wheel seat at the next reprofiling, medium or heavy maintenance level of the wheelset	
type B	> 22,5 t up to 23,5 t	Inside design limits but use to be checked case by case in accordance with wagon parameters and permitted infrastructure axle load	no special
type B	> 23,5 t	**not applied**	

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6. Limits for axle maintenance

Limits for axle maintenance

Service limit(s)

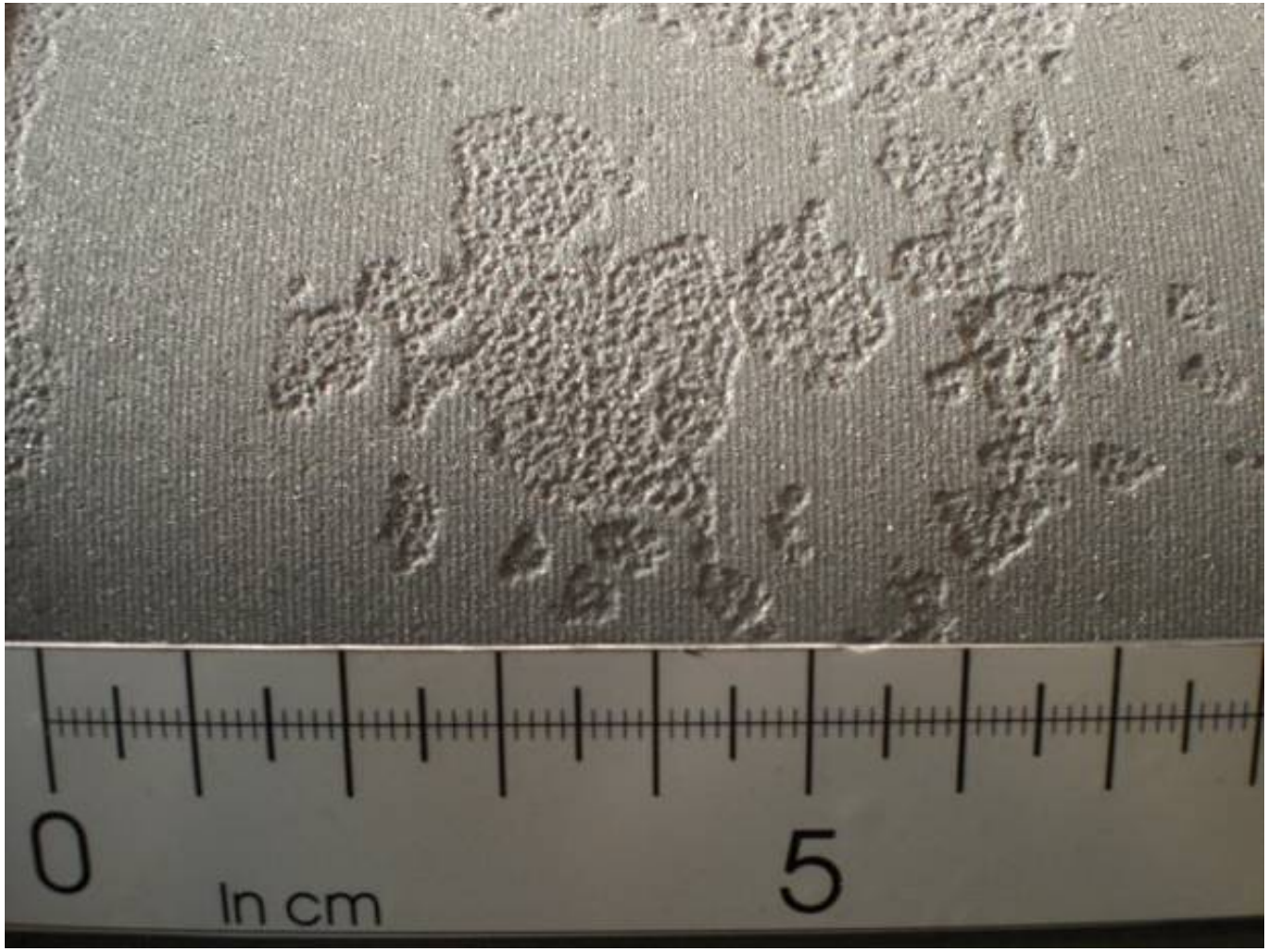
- shall only be based on condition (wear limits, **not age related**) because basic concept in dimensioning has always been the infinite life approach
- Age is not a clear indication for the status of an item (but the undergone load conditions)
- This is supported by the return of experience of the existing maintenance and monitoring systems (NDT, surface treatment,…). After maintenance/overhaul, the wheelset/axle is able to continue its operation in the foreseen maintenance plan.
- This is supported further by the Visual Inspection program with following heavy maintenance now to apply sorting out even quicker axles from operation to appropriate treatment

Surface status to be treated in medium and heavy maintenance: references

1) Local and severe defects (according UIC category 4)

Surface status to be treated in medium and heavy maintenance: references

1) Local and severe defects (according UIC category 4)



Surface status to be treated in medium and heavy maintenance: references

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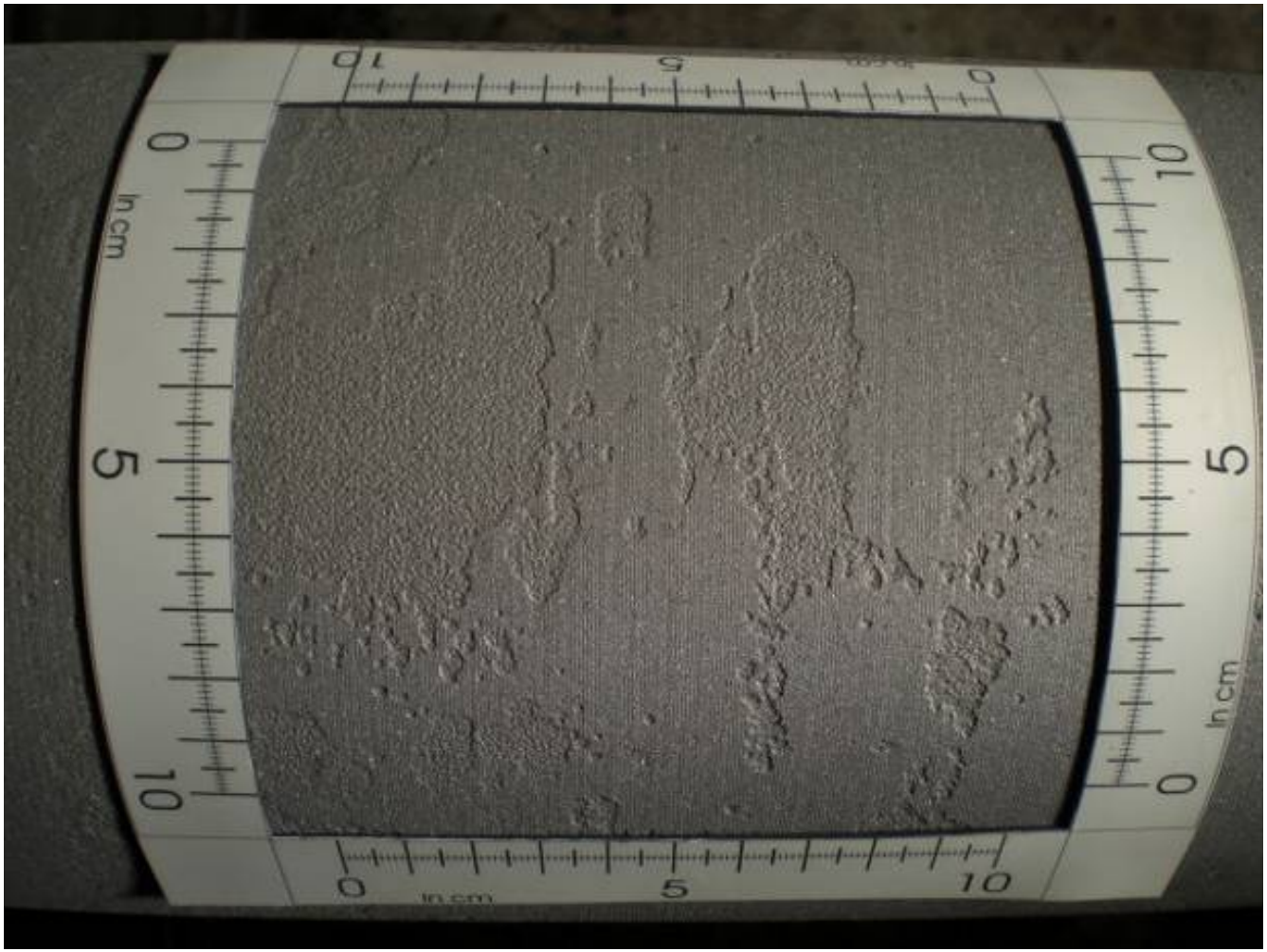

Surface status to be treated in medium and heavy maintenance: references

2) Large and heavily corroded areas, strongly and uniformly pitted surface

(link to prescriptions in EVIC:
“to be treated in next heavy maintenance”)

Surface status to be treated in medium and heavy maintenance: references

2) Large and heavily corroded areas, strongly and uniformly pitted surface

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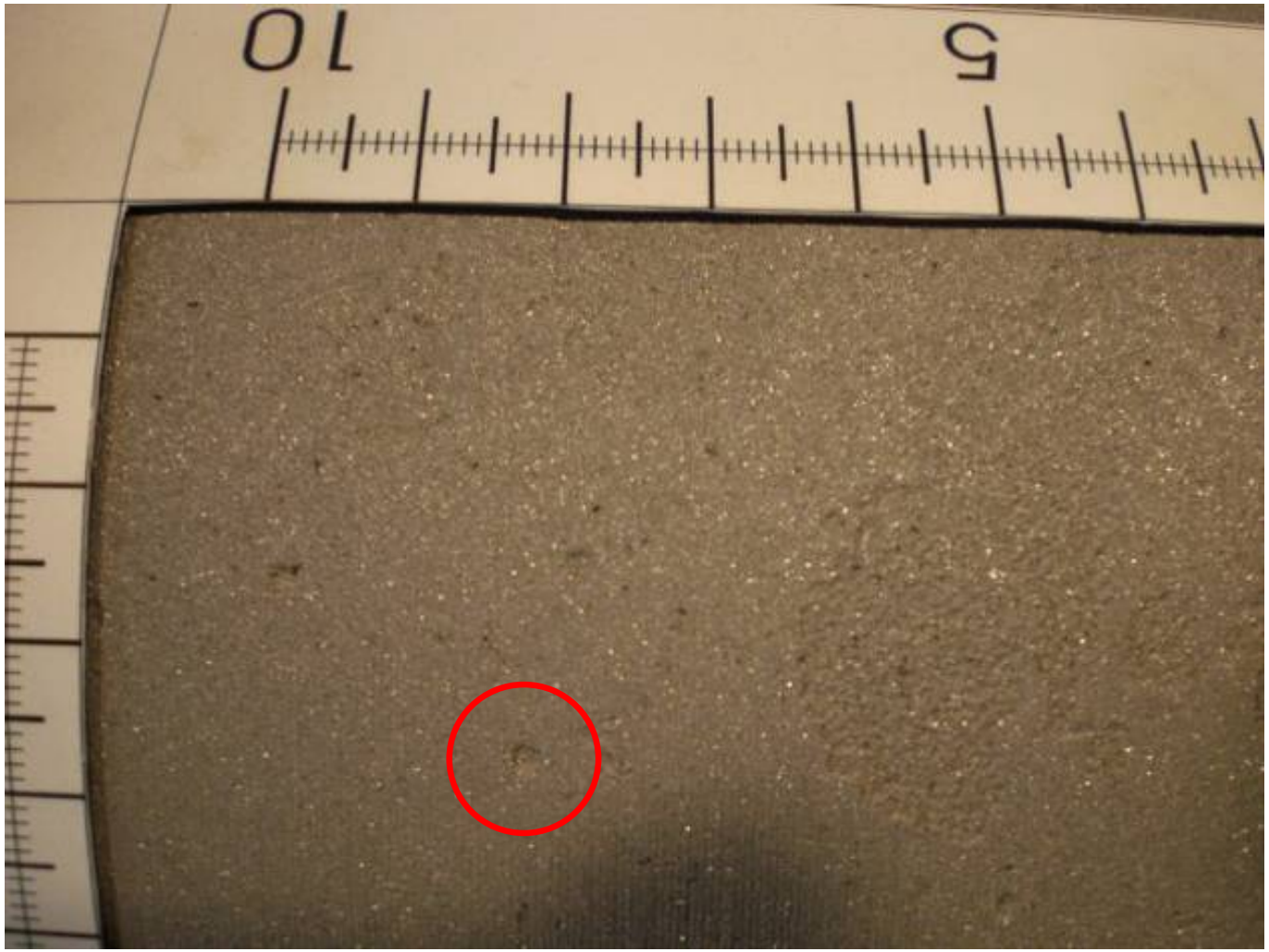

Surface status to be treated in medium and heavy maintenance: references

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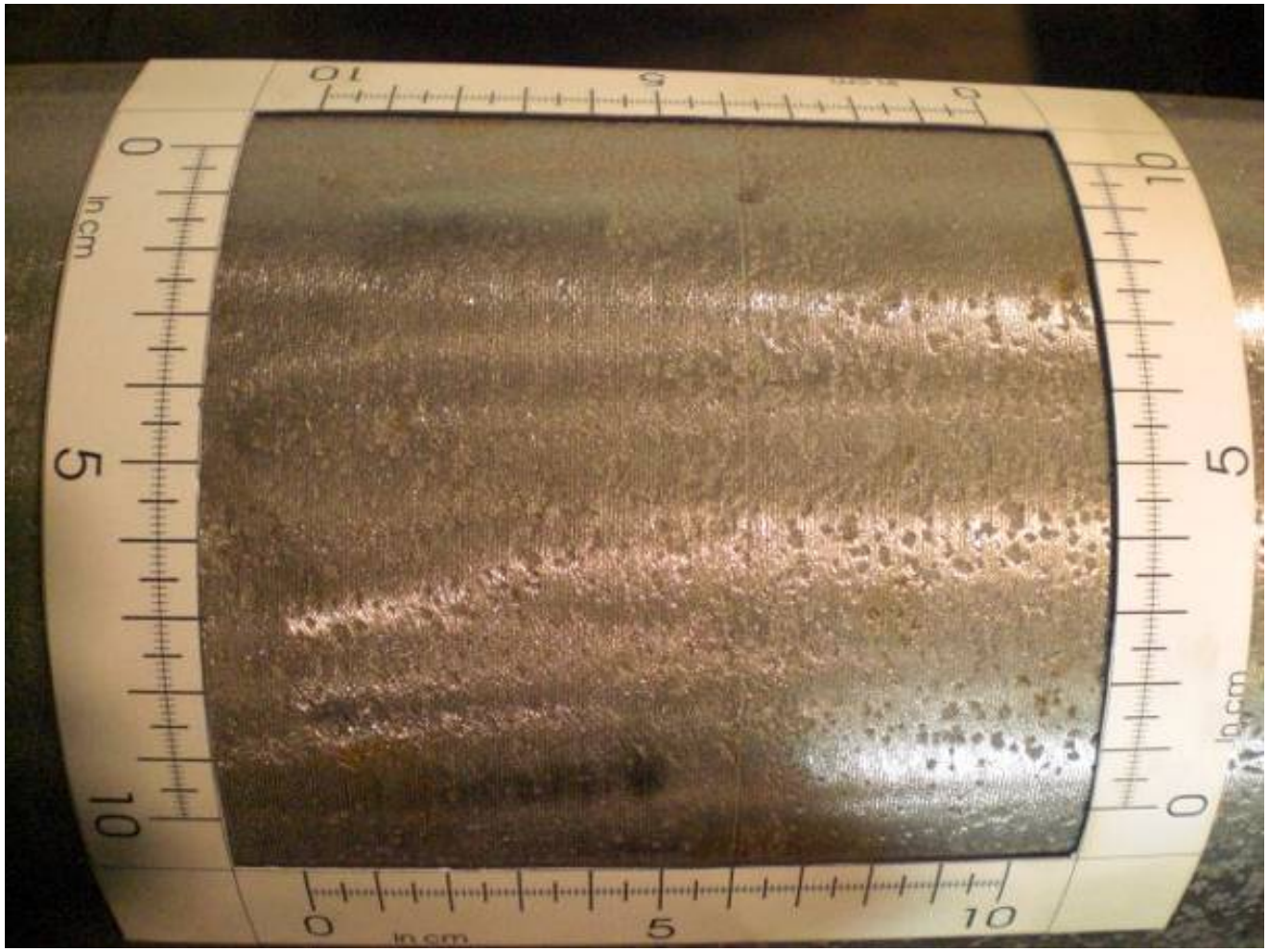

Surface status to be treated in medium and heavy maintenance: references

2) Status to be treated in transition radii and abutment area (examples)

abutment

abutment

Surface status to be treated in medium and heavy maintenance: procedure

For “medium maintenance” levels (without changing wheels, combined with bearing overhaul):

- If the surface status under coating of the axle is not clear: remove coating as far as necessary

- The surface status according to the given reference pictures must be treated or withdrawn in order to prevent potential cracks from propagation:

  1) Local and severe defects (according UIC category 4)
  2) Large and heavily corroded areas, strongly and uniformly pitted surface

- The treatment can be turning, grinding, blasting,… with subsequent NDT (according to ECCM)

The same criteria have to be applied also in the level with dismounted wheels

7. Traceability

Improved traceability of the wheelset / axle maintenance

Logging the Visual Inspection (EVIC) results

- According to EVIC decisions

General Traceability

- According to European Wheelset Traceability (EWT)

8. Measures resulting from lack of traceability

Measures resulting from lack of traceability

1. **If in a wheelset maintenance level (with axle boxes opened) one or two of the following informations for an individual wheelset is/are missing:**
   - **manufacturer**
   - **manufacturing date**
   - **manufacturing standard**

   the ECM has to decide according to its experience with its axle population about the measures to be applied. At minimum, the axle has to be subject to immediate NDT (only once).
   (The timeframe is in accordance with the European Wheelset Traceability solution).

   If no indication at all is given, the axle must be scrapped.

2. **If the existence of the following data for an individual wheelset cannot be proven on paper, databases, data band,.. (detected during the acquisition according to the European Wheelset Traceability scheme or on special request):**
   - **Workshop of last maintenance activity**
   - **date of last maintenance activity**
   - **type of last maintenance activity**

   then the axle has to be subject to immediate NDT (only once).

NDT for the axle must be performed in all cases 1. and 2. according to ECCM criteria.

Measures resulting from lack of traceability

3. **The ECM/keeper has to decide according to its experience with the operational conditions of the axles if the non traceable axle has been used in accordance with its design or with high performance parameters.**

   If this is not identifiable, the most severe NDT conditions according to the "ECCM Continued High Performance Operation" rules must be applied in the future maintenance of the axle (see this document - *ECCM final, 5. special regimes*).

9. Handling and storage

GCU appendix 10: transport and storage of parts

Principle

When wagon parts are transported, transhipped and stored before they are fitted to wagons, after their removal and in preparation for being sent back to the wagon keeper, particular care must be taken to ensure that their inner components remain undamaged and their surfaces and anti-corrosion coatings intact.

1 Wheelsets

Storage

- When stored side-by-side on the track, there must be no contact in the wheel profile area. Flange-to-flange contact is permissible.
- When stored in staggered formation (with double rail) there must be no contact between axle-box / flange or flange / axle shaft.
- When storing wheelsets in loading cradles, similar precautions must be taken.
- Storage on flat surfaces is permissible if the wheelsets are resting on suitable materials (wood, rubber, plastic) so that the surfaces in contact are not damaged.
- The wheelsets must be placed and moved in such a way that no damage can occur to the wheelset or its component parts.
- Wheelsets shall be secured against rolling away using wheel scotches, scotch blocks or hollow seats in the track.
- Stacking of wheelsets is permissible, if the above-mentioned provisions are applied for storage. Any axle-to-axle contact is forbidden.

Transport

- During transport by fork-lift truck, the tines of the fork and their ends must be fitted with protective padding. Damage resulting from wheelsets rolling off the forks should be prevented.
- If load handling attachments are used, the wheelsets must not be damaged as a result.
- Wheelsets should be transported between workshops and spare parts centres in loading cradles wherever possible. The wheelsets must be loaded and secured in such a way that there is no possible contact between them during transit. Axle-boxes must be secured against rotation.

Thank you for your attention!