Technical Specification No. 97- 43-2013. Copy No.____
for Delivery of Machined Wheels to Finland (VR Group Ltd)

Description	Machined wheels **ø 920 mm** Target size is **ø** *922+0.5 mm*
Standard	EN 13262, actual revision, category 2; **TSI**
Drawing	No. KP-0012-09.2 (reference No. 510054C) Execution of oil hole by sub-contractor is permitted
Steel grade and type of thermal treatment	**ER8**
Steel production method	*electric steel-melting with the vacuumizing and continuous steel casting*
Hydrogen content	2 ppm at the most

Steel Chemical Composition in Finished Product, Percentage

C	Si	Mn	P	S	Cr	Ni	Cu	Mo	V	Cr + Ni + Mo
at the most										
0.56	0.40	0.80	0.020	0.015	0.30		0.20	0.080	0.06	0.50

Mechanical properties	By Standard

Rim			Web	
Re N/mm²	**Rm N/mm²**	**A, %**	**Rm reduction 1) , N/mm²**	**A,%**
at the least				
540	860-980	13	120	16

[1)] Reduction of disk tensile strength as compared with actual tensile strength values of rim on the same wheel.

KU (in joules) at +20° C		KV (in joules) at - 20°C	
Average values, at the least	**Minimum values**	**Average values, at the least**	**Minimum values**
17	12	10	5

Hardness control	**Hundred-per-cent of wheels**
Hardness distribution on the surface in the batch	**No more than 30 HB**
Rim section hardness	The wheels are put to the hardness test on rim section according to the Norms **EN 13262** at the depth of 35 mm from nominal finishing diameter of wheel making up Ø 920 mm. The hardness values in point at a depth of 35 mm should be **not less than 245 HB**. The thermal strengthening shouldn't exert marked influence upon hardness in the point "A". The hardness in point A should be at the least 10 HB less as compared with hardness actual values in the point at a depth of 35 mm.
Residual stresses	In accordance with **Paragraph F.4.3. of EN 13262.** Flame cutting. The value of inter-mark distance reduction should be not less than 1 mm.
Ultrasonic inspection	As per **Paragraph 3.4.2 of EN 13262.** **Hundred-per-cent** of wheel rims in axial and radial direction, **Defect of 2 mm** – by Manufacturer's method.

Specification approved
Helsinki, 2.5.2013
Pentti Kuokkanen

Executing officer Ye. V. Volokita. Telephone 35-82-77

Magnetic-particle test	**Hundred-per-cent** of wheels in accordance with **Paragraph 3.6.2. EN 13262**
Macrostructure	Deep-etching method: The availability of flockens, delaminations, folded and sunk sinterskins, nonmetallics, residual shrinkage holes and other metal integrity defects isn't permitted.
Microstructure	In accordance with **ISO 643.** The grain size **shall not be higher** than **the 6th number.** The inspection should be carried out on the samples subjected to a tensile test.
Non-metallic inclusions	Number of **non-metallic inclusions** in accordance with **method A of ISO 4967**

Type of non-metallic inclusions	**Thick/thin series (maximum)**	**Type of non-metallic inclusions**	**Thick/thin series (maximum)**
A (sulfides)	1.5/2	**D** (globular oxides)	1.5/2
B (aluminates)	1.5/2	**B+C+D**	3/4
C (silicates)	1.5/2		

Repeated heat treatment	Single additional hardening and two additional tempering at the most.
Surface finish	The wheel components should be free from defects according to Paragraph 3.6 EN 13262.
K_1C test	When delivery of wheels, the test for fracture toughness index Kq (K1C) is determined at every cast in accordance with **Paragraph L.2.2.2 of Appendix L (TSI)** and **Paragraph 3.2.5 EN 13262.** • the average value obtained by 6 test samples should make up **at the least 70 N/mm$^2\sqrt{m}$;** • the individual value for each of 6 measurements should make up **at the least 60 N/mm$^2\sqrt{m}$;**
Residual imbalance	**75 gm at the most**
Appearance and dimensions	**No. KP-0012-09.2, Paragraph 3.6.** of EN 13262.
Marking	The marking is applied on wheel hub surface on the inside, cold, at the distance of 10 ± 2 mm from the outer diameter of hub to the beginning of marking symbols in figures being 8 + 2 mm high and at the least 0.2 mm deep. It is prohibited to use pointed stamps. The marking should be read from the wheel centre. The distance between symbols should make up at the least 3 mm coming to at the least 20 mm between the groups of symbols.
Marking procedure	1. Conventional name of the Manufacturer: *KLW* 2. Number of heat: *5 symbols* 3. Ordinal number of a wheel in a heat: *3 symbols* 4. Date of manufacture: *the month and the last two figures of manufacturing year.* 5. Steel grade: *ER8* 6. Place for Inspector's mark 7. Finnish railway marking - **VR**
Additional marking of residual imbalance	The Residual Unbalance Position is marked on the rim inside by radial strip with paint (about 15 mm wide). The unbalance value **E2 shall** be indicated below the strip end.

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Coating	The wheels are delivered with the coating: Teknodur Combi 3560-75, RAL5003, blue color, thickness 1x120 μm. The coating is applied on the web area, on zones of transition from web to hub and from web to rim, on hub ends. The coat is not applied on hub hole, rim ends, oil hole, tread and flange. The coating is applied by sub-contractor «VRZ-99» AD (Bulgaria). The coating is recommended by customer.

Packaging into cages

The wheels are delivered in metal cages complete by groups. An additional marking - actual diameter (2 signs after comma) is applied on the tapping line. Wheels that are not completed by groups could be completed in the combined cages.

Range, mm	922, 00 ÷ 922,50	Other wheels, i.e. 920, 00 ÷ 921,99 and 922,51 ÷ 924,00
Wheels volume, %	50 ÷ 70	Rest of volume
Packaging in cages	Separate cages	The wheels are completed in pairs, with tolerance 0,5 мм.

Guarantee	The Manufacturer guarantees compliance of wheels with the requirements of this Technical Specification subject to sticking to conditions of operation, storage, transportation and assembly. The Quality Guarantee term is 60 months since the date of commissioning of transport vehicles in which the Goods are being operated but 72 months since the date of delivery at the most. *The guarantee doesn't apply to temporary rust-preventive coat*

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