Factory Acceptance Test of
Industrial tow tractors with 30t pulling force

VOLK EFZ 30NK
Tractor Nr 1

1. GENERAL INFORMATION

1.1. FAT DATE : 15-09-2006

1.2. PLACE : VOLK Fahrzeugbau / 88339 Bad Waldsee

1.3. PERSONS PRESENT

CERN : JM CHEVALLEY
Steinbock : P. SCHIBLI
VOLK : S. SCHMID

1.4. Scheduled delivery date

Week 40 (Both tractors) / To be confirmed
All modification mentioned in this report shall be done as required by CERN before the shipment.

1.5. Internet link

http://www.steinbock-ag.ch
http://www.volk-fahrzeugbau.de/

2. TECHNICAL REQUIREMENTS

2.1. Major Characteristics

	Type	*Electric tractors with 30 t pulling force (minimum)*
1	*Engine type*	*Electric*
2	*Hook type*	*3 positions hook for a total pulled load of 30 t – front and rear*
3	*Delivery needed for*	*12 weeks after the order being notified*

2.2. Environment

1	*Indoor/Outdoor*	*Indoor/underground tunnel*
2	*Temperature range*	*10 to 30° C*
3	*Average ground slope*	*1,5 %*
4	*Max. slope*	*5 %*

2.3. Use

1	*General*	*To pull any material to be installed in the tunnel*
2	*Most intensive use*	*2/3 hours/day working by transferring 30t loads in place and return on an average tilt of 1,5 %*
3	*Life*	*10 years life at 8 working hours per day. 3 hours per day pulling a 20 t load.*

2.4. Required characteristics

N°	**Designation**	**CERN's requirements**	**Unit**	**Volk's proposal**	**FAT Comments**
1	Proposed mark		---	VOLK	**YES**
2	Proposed manufacturer		---	VOLK	**YES**
3	Assembly city and country		---	Bad Waldsee	**YES**
4	Type		---	EFZ 30NK	**YES**
5	Engine type	Electric	---	Electric	**YES**

6	Wheel number	4	---	4	**YES**
7	Steering wheels number	2	---	2 (Front)	**YES**
8	Driving wheels number	2 mini	---	2 (Rear)	**YES**
9	Braking wheels number	all	---	4	**YES**
10	Number of front wheels		---	2	**YES**
11	Number of rear wheels		---	2	**YES**
12	Wheels type and material	Super elastic	---	CSE	**YES**
13	Wheel material hardness	less than 90	Shore A	less than 90	**Volk info**
14	Front suspension type		---	Screw type	**YES**
15	Rear suspension type		---	Lcaf type	**YES**
16	Towing capacity at 3 %	30 mini	t	30t Max	**Volk info**
17	Tow traction force	6000 mini	N	6000 Nominal	**Volk info**
18	Conductor position	Seated	---	Seated	**YES**
19	Number of passenger (driver included)	1	---	1	**YES**
20	Power assisted steering (type)	Hydraulic	---	Hydraulic	**YES**
21	Seat belt	See Spec 4.3	---	Seat belt	**YES**
22	Lifting points/bolts for handling	See Spec 4.8	---	4	**MISSING**
23	Sketch for lifting configuration	See Spec 4.8	---		**MISSING**
24	Lifting tools (Ring/shackles/bolts)	See Spec 4.8	---		**MISSING**

2.5. Dimensions

N°	Designation	CERN's requirements	Unit	VOLK's proposal	FAT Comments
1	Overall width	1300 max	mm	1250	**1250**
2	Overall length	2500 max	mm	2413	**2500/2740**
3	Overall height	1700 max	mm	1290	**1340**
4	Driver seat height	900-1200	mm	992 / 985	**910**
5	Suspended seat type		---	Yes	**YES**
6	Ground clearance	100 min	mm	170	**95**
7	Front external turning radius	2800 max	mm	2745	**Volk info**
8	Internal turning radius		mm	805	**Volk info**
9	Minimum corridor to turn 180 degrees (Ast)		mm	2345	**Volk info**
10	Weight batteries included		kg	3690	**Volk info**
11	Load on front axle		kg	1350	**Volk info**
12	Load on rear axle		kg	2250	**Volk info**

13	Front wheels diameter		mm	654	**640**
14	Rear wheels diameter		mm	654	**640**
15	Wheel entraxe distance		mm	1250	**1085**
16	Tow hook height (Front) / diameter 25mm minimum / Depth 65mm min	300-400 / 3 pos	mm	300-400 / 3 pos (30mm/65mm)	**170/260/360**
17	Tow hook height (rear) / 25mm minimum	300-400 / 3 pos	mm	300-400 / 3 pos (30mm/65mm)	**200/285/395**
18	Colour – RAL number		---	RAL 2004	**RAL 2004 orange**

2.6. Batteries and chargers

N°	Designation	CERN's requirements	Unit	VOLK's proposal	FAT Comments
1	Batteries mark		---	HAWKER	**YES**
2	Batteries model		---	6PzS 480	**YES**
3	Battery type		---	Traction	**YES**
4	Batteries Voltage	80	V	80	**YES**
5	Batteries capacity	400 mini	Ah	480	**YES**
6	Battery discharge level	Percentage or voltage	---	Percentage charging status	**YES**
7	Number of on-board battery units		---	1	**YES**
8	Battery charger mark		---	Tebetron	**YES**
9	Battery charger model		---	Puls D400	**YES**
10	Charger type	standard	---	G80/45 B-FTP	**YES**
11	Charger site	external	---	2m cable	**YES**
12	Charger power feed	380 AC	V	380V AC	**YES**
13	Charger current		A	45A	**YES**
14	Charging time (Deep cycle)	12 maxi	h	12H	**YES**
15	Number of charging cycles / battery life		cycle	1500	**Volk info**
16	Indicator if battery under charging	See Spec 4.3	---		**MISSING**
17	Water filling system		---		**YES**
18	Hourly counter	See Spec 4.3	---		**YES**

2.7. Performances

N°	Designation	CERN's requirements	Unit	VOLK's proposal	FAT Comments
1	Speed	10 km/h max	km/h	5km/h loaded	**4km/h**

		loaded			**Volk info**
2	Speed	10 km/h max unloaded	km/h	14km/h unloaded	**15km/h Volk info**
3	Admissible tilt and slopes with 30t	5 mini	%	5% / S2=2 min	**Not tested**
4	Variable speed (Microprocessor)	Yes	---	ZAPI	**YES**
5	Motor producer		---	Atech	**YES**
6	Type of electric motor	*Asynchronous*	---	DC	**YES**
7	Motor installed power	10 min	kW	12	**12KW**
8	Power assisted steering	See Spec 4.2			**YES**

2.8. Brakes and suspensions

N°	Designation	CERN's requirements	Unit	VOLK's proposal	FAT Comments
1	Front service brakes (Brake pedal)	Yes	---	Yes	**YES**
2	Rear service brakes (Brake pedal)	Yes	---	Yes	**YES**
3	Parking brakes type to retain 30t at 5% slope	Hand brake or automatic when switching off	---	Automatic when switching off / retain 30t at 3% slope	**YES Not tested Only 3% !**
4	Front suspension	Yes	---		**YES**
5	Rear suspension	Yes	---		**YES**
6	Braking system (Gas pedal)	Yes	---		**YES**
7	Hydraulic unit			Brake/Steering	**YES**

2.9. Safety

N°	Designation	CERN's requirements	Unit	VOLK's proposal	FAT Comments
1	Horn on dashboard	Yes	---	Yes	**YES**
2	Front lighting	2 lights	---	2 lights / Grid protections	**2 lights Grid missing**
3	Rear stops (Stop for braking action indication)	2 lights	---	2 lights / Grid protections	**2 lights Grid missing**
4	Dead-man pedal	Yes	---	Switch on seat	**No pedal Switch on seat tested**
5	Starting key required	See 5.3	---	3 RONIS 455	**2 keys**
6	Inversion lever on dashboard	Yes	---	Yes	**YES**
7	Front shock absorber	Yes		Yes	**Frame**

8	Rear shock absorber	Yes		Yes	**Frame**
9	Front shock absorber thickness	4 min	mm	4mm steel	**5 mm**
10	Rear shock absorber thickness	4 min	mm	4mm steel	**70 mm**
11	CE mark	Yes		Yes	**MISSING**
12	Plate indicating (Tow/Battery/Year)	See Spec 4.9			**MISSING**
13	Emergency push button on dashboard				**MISSING**
14	Emergency push button on rear dashboard			Only active in this local mode	**YES**
15	Hand pump and ball valve for brake system (emergency recovery)				**YES**
16	All indications in F or E	See spec 6.1			**Germany**

2.10. Electrical box

N°	Designation	CERN's requirements	Unit	VOLK's proposal	FAT Comments
1	Protection (Fuse)		---		**YES**
1	Motor protection (Max pulling)		---		**YES**
3	Speed adjustment		---	ZAPI Console	**YES**
4	Software/EPROM		---	ZAPI/VOLK	**YES**

2.11. Test

N°	Designation	CERN's requirements	Unit	VOLK's proposal	FAT Comments
1	Function test unloaded at 0%				**Tested**
1	Function test loaded 8t at 8%				**Tested**
1	Speed test unloaded at 0%	10 max	km/h	15 km/h	**Not tested**
2	Speed test loaded 30t at 5%	10 max	km/h	4 km/h	**Not tested**
3	Speed test loaded 8t at 8%	10 max	km/h	14 km/h	**Not tested**
4	Hand brake test / Unloaded at 0%				**Tested**
5	Hand brake test / loaded 30t at 5%				**Not tested**
6	Hand brake test / loaded 8t at 8%				**Tested**
7	Max pulling force at 0%	6000 minimum	N	6000 minimum	**23700**
8	Motor protection (Max pulling)				**Tested**

2.12. Documentation

N°	Designation	CERN's requirements	Unit	VOLK's proposal	FAT Comments
1	Scale layout drawing (Key dimension)	See Spec 6.2	---	FN 133240	***Not correct***
2	After sales support arrangements	See Spec 6.2	---		**YES**
3	Planned maintenance schedule for the 10 year period	See Spec 6.2	---		**YES**
4	2 x operating manual (French)	See Spec 6.3.1	---	Only in English	**In work**
5	2 x maintenance manual (French)	See Spec 6.3.1	---	Only in English	**In work**
6	2 x electrical diagram	See Spec 6.3.1	---	Only in English	**YES**
7	2 x hydraulic diagram	See Spec 6.3.1	---	Only in English	**YES**
8	2 x spare parts catalogue	See Spec 6.3.1	---		**YES / *No supplier address***
9	Mechanical drawing (AutoCad)	See Spec 6.3.1	---		**In work**
10	CE Declaration of conformity	See Spec 2	---		**In work**

Remarks and open points:

The following items do not meet the requirements stipulated in the specification DO-21148/TS :

Table 2.4 / Pos 22 : Lifting points missing

The tractor shall be equipped with 4 adequate lifting points as stipulated in chapter 4.8 (DO-24148)

➔ To be done before delivery

Table 2.4 / Pos 23 : Lifting points missing

The contractor shall provide a sketch showing the lifting configuration as stipulated in chapter 4.8 (DO-24148)

➔ To be included in the documentation

Table 2.4 / Pos 24 : Lifting points missing

Lifting tools shall be included in the supply as stipulated in chapter 4.8 (DO-24148)

➔ To be included in the supply

Table 2.5 / Pos 2 : Overall length

The overall length is 2740mm including front and rear hooks instead of 2500mm max

➔ Non-conformity accepted by CERN (C. Bertone and S. Pelletier)

Table 2.5 / Pos 6 : Ground clearance

The ground clearance is 95mm instead of 100mm max

➔ Non-conformity accepted by CERN (C. Bertone and S. Pelletier)

Table 2.5 / Pos 16 : Tow hook height (Front)

The height of the intermediate position is 260mm (Between 300 and 400mm according to the specification chapter 4.3)

➔ Non-conformity not accepted / The height of the upper position must be 420mm (middle)

➔ To be modified before delivery

Table 2.5 / Pos 17 : Tow hook height (Rear)

The height of the intermediate position is 285mm (Between 300 and 400mm according to the chapter 4.3)

- ➔ Non-conformity not accepted / The height of the upper position must be 420mm (middle)
- ➔ To be modified before delivery

Table 2.6 / Pos 16 : Indicator if battery under charging

The tractor is not equipped with an indicator if battery is under charging.

As explained the same battery connector is used for the motor powering and battery charging and therefore no additional indicator is needed. However CERN assume that the external charger is equipped with an indicator if battery is under charging

- ➔ To be confirmed by Steinbock/Volk

Table 2.7 / Pos 2 : Max speed (unloaded)

The maximum speed (unloaded) must be 10km/h as stipulated in chapter 4.1 (DO-24148)

- ➔ Max speed shall be adjusted at 10km/h

Table 2.7 / Pos 3 : Admissible tilt and slopes with 30t

Not possible to carry out this test during the FAT

- ➔ To be tested at CERN during the provisional acceptance test

Table 2.8 / Pos 3 : Parking brakes type to retain 30t at 5% slope

Not possible to carry out this test during the FAT

- ➔ Steinbock/Volk has to confirm that the brake can retain 30t at 5% slope or indicate the max admissible slope.
- ➔ To be tested at CERN during the provisional acceptance test
- ➔ The tractor shall be equipped with chock wheel (To be done before delivery)

Table 2.9 / Pos 2/3 : Front and rear lights / Grid protections missing

- ➔ To be installed before delivery

Table 2.9 / Pos 4 : No Dead man pedal (Only seat contact)

- ➔ Non-conformity accepted by CERN (SC Department / B. Delille)

Table 2.9 / Pos 5 : Key 455 / RONIS Delivery problem

- ➔ Non-conformity accepted by CERN (HM JM Chevalley)

Table 2.9 / Pos 11/12 : CE Plate / General information

- ➔ To be installed before delivery

Table 2.9 / Pos 13 : Emergency push button

No emergency push button has been foreseen since there are a brake pedal and the battery connector next to the driver. However an emergency stop button is required in case of electrical problem. It could be installed on electrical box as discussed during the FAT (See photo)

➔ To be installed before delivery

In addition the emergency push button placed on the back side being only active when using the local rear mode, a warning plate must be installed next to the Emergency button mentioning this fact.

➔ To be installed before delivery

Table 2.9 / Pos 15 : Hand pump (Brake)

The pump and ball valve used for opening manually the brake in case of breakdown shall be covered by a fixed cover in order to avoid any risk of opening the brake by mistake.

➔ To be installed before delivery (Photo to be sent before delivery for CERN approval)

Table 2.9 / Pos 16 : All indication shall be in French or English

The indication plate 'Vorwaerts/Rueckwaerts' shall be replaced by a plate with 2 arrows (Front/Back direction) as discussed during the FAT.

➔ To be modified before delivery

Table 2.11: Static and dynamic tests with 30t at 5%

It was only possible to test the tractor with 8t at 8% during the FAT

➔ To be tested at CERN with 30t at 5% and 3% according to the load table.

➔ Load table (load/slope/time) shall be included in the delivery

Table 2.12 / Pos 1 : Scale layout drawing (Key dimension)

The drawing FN 13 32 40 showing all key dimensions is not correct and has to be modified.

For instance the ground clearance, driver, seat height, tow hook height ere not as built.

➔ The drawing FN133240 must be sent before the delivery in order to check all dimensions

Table 2.12 / Pos 4/5: Operating and maintenance manuals in French

As stipulated in the chapter 6.3.1 the operating and maintenance manuals shall be in French.

CERN will only accept the version in English providing that Volk provides:

- 2 copies including all documents (in English)
- A CD containing all documents, electrical and hydraulic diagram, etc.. (Format PDF/AutoCad) and also the operating and maintenance manuals in DOC format (WORD) in order to be able to translate the most important chapters in French.

➔ To be confirmed by Steinbock/Volk

➔ Documentation and CD to be included in the delivery

Table 2.12 / Pos 10: CE Declaration of conformity

➔ To be included in the delivery

Table 2.12 / Pos 8: Spare material

Steinbock/Volk shall provide an offer for the recommended spare parts (ZAPI control unit, electronic board etc…) to be held at CERN.

➔ Offer to be provided by Steinbock/Volk before the provisional acceptance