

19 September 2005

Dno. 1836/731/05

TECHNICAL TERMS OF DELIVERY FOR POINT MACHINES

Finnish Rail Administration has approved the Technical Terms of Delivery for Point Machines Dno.1836/731/05 to be valid on the Finnish rail network as from **26 September 2005**.

These technical terms of delivery replace all previous technical terms of delivery and general technical requirements for point machines of long and short turnouts, for crossings with movable frogs and derailleurs.

Director, Rail Network Department Markku Nummelin

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APPENDICES

Appendix 1 Positioning of the slides, drawing 4022 421C4522D

Appendix 2 Mounting parts, drawing 4022 422D4507D

Appendix 3 Drive rod, drawing 4022 422D3915C

Appendix 4 Detector slide, drawing 4022 422E3919B

Appendix 5 Point machine connections, drawing

1 GENERAL

These technical terms of delivery specify technical requirements for point machines of switches, crossings with movable points and derailleurs to be procured for Finnish State rail network. So-called speedy point machines and other special point machines are excluded from these terms of delivery.

More accurate test arrangements for an operational test (qualification approval) are to be specified separately.

Point machine must function for both right- and left-hand turnouts, and for both right- and left-hand installations. In terms of derailer, point machine must function for both right- and left-hand installations.

Point machines which are mounted to the sleeper outside half pair of switches and equipped with built-in locks, or point machines which are built into sleeper (i.e. integrated point machines) shall be used in Finland.

Stock rail fastening to the integrated point machine shall be such that allows adjustments to be made in track gauge. Stock rails shall be insulated, as well as switch blades.

Point mechanism and its lubrication are to be designed in the manner that allows reliable operation despite of temperature changes between the upper and lower limits.

Point machine or turnout cannot get damaged if switch tongues are prevented from turning, and point machine aims to open them. The damage must be prevented using a friction clutch or a similar device. Interlocking turns off the actuating current 10 seconds after it has been connected. Point machine must allow switch-over operation in any position between the start and end positions, also during the motion. Same requirements apply for operation of a derailer point machine if it is prevented from turning.

Point machine shall have a Finnish Rail Administration's (RHK) approved cable terminal that has a flexible connection to the point machine. Connection cables must be clearly identified and separated from each other.

Supplier shall secure that when delivered all parts including the rod ends are protected against corrosion.

1.1 Drive rods and detector slides

Point machine must be equipped with two drive rods, one for each blade. Mutual operation of rods varies between point machine types. Point machine motion shall not be jerky, but to move smoothly.

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Point machine must be equipped with two separately functioning detector slides, one for each blade. Positioning of the slides and mounting parts are presented in drawings 4022 421C 4522F (Appendix 1) and 4022 422D 4507H (Appendix 2). Detector slide adjusting capacity must be equal with adjusting capacity of switch-over movement.

Drive rod and detectors slide ends of integrated point machine shall be attachable to switch blade holes. Rod fastenings must allow switch blade to rise (2 mm) over the rollers when point is switched.

Free ends of slides must be covered with protective shield.

Connections of point machine slides and rods to slides and rods of a switch must be according to the drawings 4022 422D 3915 C (drive rod, Appendix 3) and 4022 422E 3919B (detector slide, Appendix 4).

1.2 Point lock

Point machine shall have a built-in point lock that is mechanical.

The lock shall be inside the point machine or mounted into the point sleeper. Derailer point machine shall not have a lock.

The structure should be such that point lock is not to be affected by forces that are initiated as switch blade moves 3 millimetres to any direction

1.3 Contact device

Point machine must be equipped with electromechanical contacts that break circuit and supervise each end positions of both blades with two separately functioning detector slides. Temperature limits must especially be considered in operation of contacts.

Derailer point machine must be equipped with electromechanical contacts that break circuit and supervise both end positions of drive rod with detector slide. Temperature limits must especially be considered in operation of contacts.

1.4 Motor

Point machine motor shall be an alternating-current asynchronous motor, voltage rating 3 x 400 V ± 10 %, 50 Hz.

Point machine must provide torsional moment needed for throwing force, when supply cable resistance is $\leq 40 \Omega/\text{wire}$. Then switching time shall be ≤ 6 seconds.

Throwing force directed to the blades shall be adjustable later on. Throwing force is to be measured without detector slides. Limits of

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throwing force directed to the blades are: < 4.3 kN in the beginning of switch-over movement and 4.8 kN in the end.

Point machine is to be operated with such connection to the interlocking and contact device as specified in Appendix 5.

Actuating current is switched off from interlocking 10 seconds after switch-on.

Point machine must allow manual switchover with a hand crank that shall not be positioned in point machine during the normal operation. Manual operation shall be technically inhibited unless motor circuit is switched off.

1.5 Housing

Housing cover of point machine shall be lockable. It shall be made of hot-galvanised steel plate that is at least 2 mm thick.

All electrical parts shall be contact protected, grounded, and suitable for continuous outdoor conditions (IP33, IEC 529).

All voltage parts are tested against each other in both switch-over movement end positions for every point machine. Testing voltage is 750 V DC. Insulation shall be sufficient. Components that may be harmed by the use of direct current (capacitors, etc.) can be given exceptions.

Insulation test between voltage parts and frame shall be undertaken as a type test. The test time shall be one minute with a voltage of 2.5 kV and frequency of 50 Hz.

Insulation test between voltage parts and frame shall be undertaken as a delivery test. The test time shall be 2 seconds with a voltage of 2.0 kV and frequency of 50 Hz.

With regard to grounding there shall be at least one visible and easily available, minimum M16-sized screw in the housing.

In terms of maintenance, mechanism of integrated point machine shall be easily interchangeable. Sleeper shall remain on track.

The housing shall be manufactured in the manner that prevents humidity to condense in the structure.

1.6 Measurements

The largest permitted height for point machine is 250 mm and downward 200 mm.

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The height is measured from sleeper's surface. Point machine must be suitable for sleeper spacing of 670 mm (Free space between sleepers 400 mm) and for fixing space of 280 × 694 mm (See Annexes 1 and 2).

Maximum width of integrated point machine is 400 mm. The maximum length is 3000 mm. The part under the stockrail has a maximum height of 220 mm.

1.7 Noise

Noise level shall be under 70 dB(A).

1.8 Points signal installation

Points signal is to be connected to point machine in the manner that enables it to turn 90 degrees when it is turned by the rod next to heel of blade.

1.9 Documentation

Every point machine shall be delivered with installation manual written in Finnish and a SFS standard circuit diagram. Each delivery shall also contain a maintenance and repair manual and a list of spare parts in Finnish language.

2 DELIVERY TESTS

Supplier shall undertake delivery test for point machine. In tests, correct functioning of a circuit breaker is tested and faultless condition and lubrication of all parts is checked. Also, an insulation resistance, a throwing force, a switchover movement length tests are undertaken. Trailing force test is undertaken for trailable point machines.

In the actuating current test, actuating current is measured for both sides in the beginning and in the end of switchover movement.

In the locking force test, locking force is tested for both throwing directions in the beginning, in the middle and in the end. Drive rod is hold on until the holding force is exceeded. The locking force is same as the holding force.

In the trailing force test, trailing force is measured for both throwing directions. Point machine is switched into one of its end positions, and unlocked drive rod is pulled until the locking of the point machine is opened. The trailing force is same as the pulling force. A maximum pulling speed is 0.5 m/s.

In the movement length test, movement length is measured for both directions. Plays must be removed before commencing the test. After that point machine is switched for both of its end positions.

Circuit breaker test: Hand crank must turn off the circuit of the point machine.

3 TRAILABLE POINT MACHINE, SHORT TURNOUTS

Point machine shall have two separately functioning drive rods.

After a trailing has occurred at permitted trailing speed, the point machine must allow operation without additional procedures. In trailing situation, switch blades are to be released at specific speed and force without damaging the point machine.

3.1 Functional limits

	Nominal	Tolerance	Unit
Operating temperature range		-40...+50	°C
Static throwing force	3800	± 500	N
Operating voltage 50 Hz 3~	400	± 10 %	V
Control voltage DC	60	± 10	V
Switching time	4	-2... + 2	s
Actuating current	6*	+0	A
Switchover current	2.5	+0.5	A
Movement length	162	-2.5... + 3	mm
Trailing force	6000	± 500	N
Trailing speed	40	-0 + 10	km/h

* Permitted 6 A for a short term, the system has 4 A slow fuse.

4 NON-TRAILABLE POINT MACHINE, LONG TURNOUTS AND MOVABLE CROSSINGS

Point machine must be equipped with two rods that move simultaneously during the switch. One is an active drive rod and locking bar, and the other is a passive locking bar.

Point machine shall not be trailable.

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4.1 Functional limits

	Nominal	Tolerance	Unit
Operating temperature range		-40...+50	°C
Throwing force			
a) Point machine (tip of switch)	3800	± 500	N
b) Point machine (heel of blade)	4300	± 500	N
c) moveable frog	4300	± 500	N
Operating voltage 50 Hz 3~	400	± 10 %	V
Control voltage DC	60	± 10	V
Switching time	4	-2 ... +2	s
Actuating current	6*	+0	A
Switchover current	2.5	+0.5	A
Movement length			
a) Point machine (tip of switch)	143**	-2.5 ... + 3	mm
b) Point machine (heel of blade)	94***	-2.5 ... + 3	mm
c) moveable frog	94***	-2.5 ... + 3	mm

* Permitted 6 A for a short term, the system has 4 A slow fuse

** Point machine must be modifiable to allow operation with internal or external devices with nominal movement length of 100–143 mm

*** Point machine must be modifiable to allow operation with internal or external devices with nominal movement length of 36–94 mm

5 DERAILER POINT MACHINE

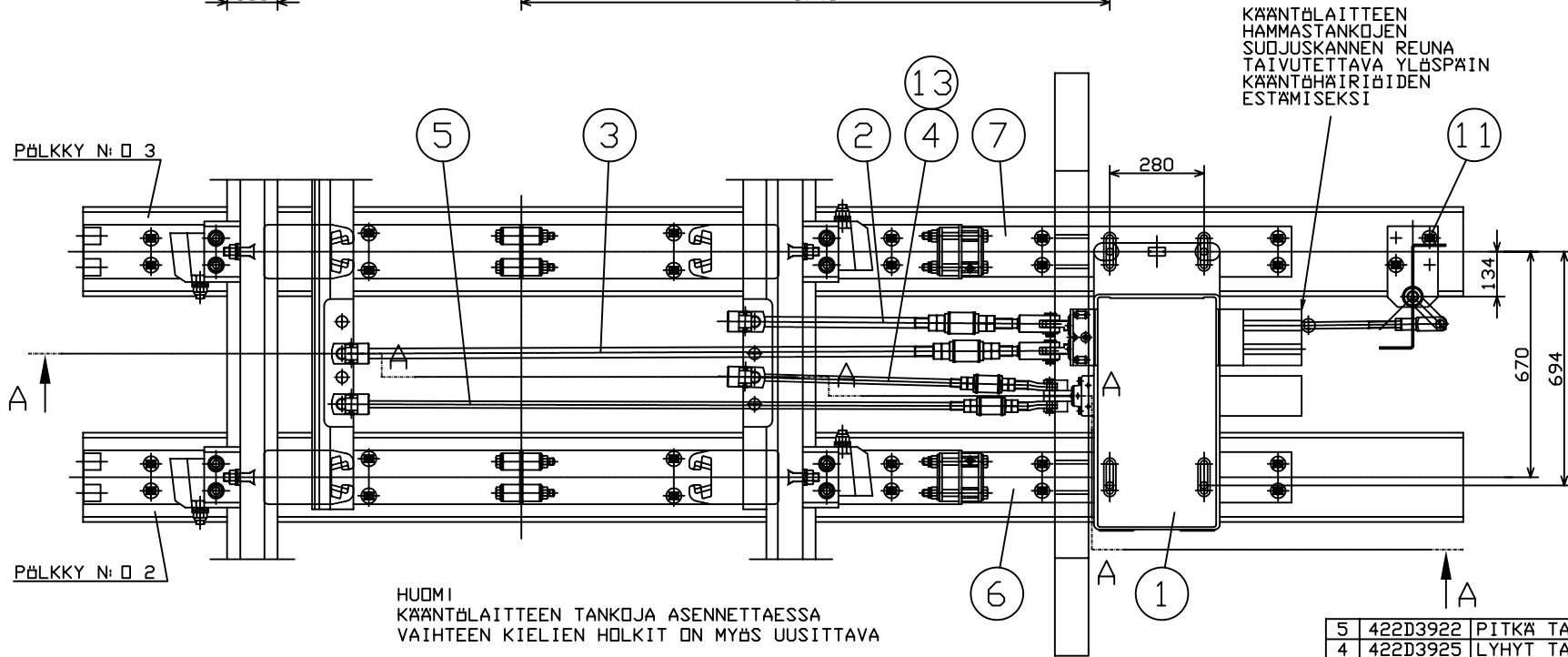
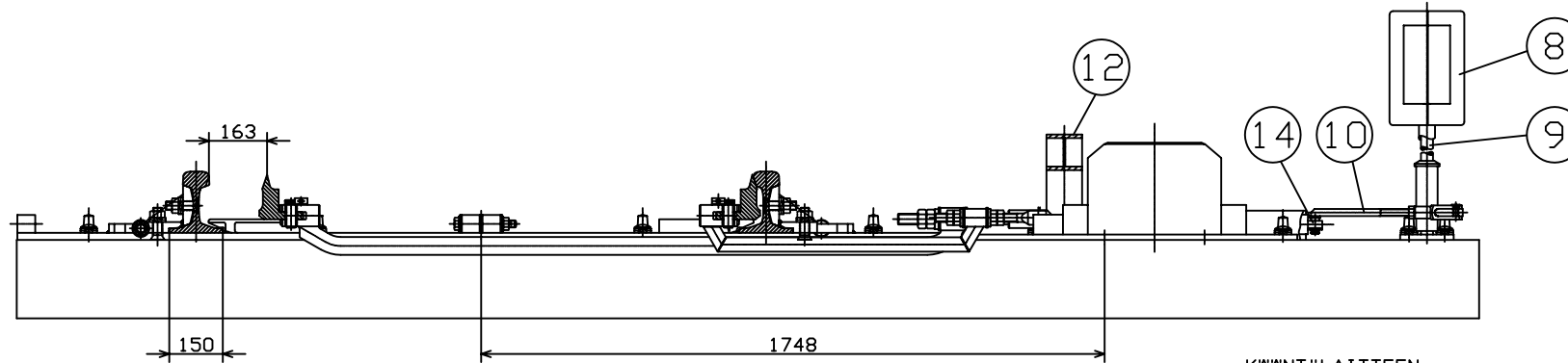
Point machine must be equipped with one functioning drive rod.

5.1 Functional limits

	Nominal	Tolerance	Unit
Operating temperature range		-40...+50	°C
Throwing force	4000	± 500	N
Operating voltage 50 Hz 3~	400	± 10 %	V
Control voltage DC	60	± 10	V
Switching time	6	-2... + 2	s
Actuating current	6*	+0	A
Switchover current	2,5	+0.5	A
Movement length	240	-2.5... + 3	mm

* Permitted 6 A for a short term, the system has 4 A slow fuse

MERKKI	MUUTOS	PVM MUUTANUT
D	OSALUETTELOMUUTOS	31. 5. 95 AMA
E	ALUSLAATAT VAIHDETTU	3. 9. 99 AMA
F	OSALUETTELOMUUTOKSIA	14. 11. 00 AMA

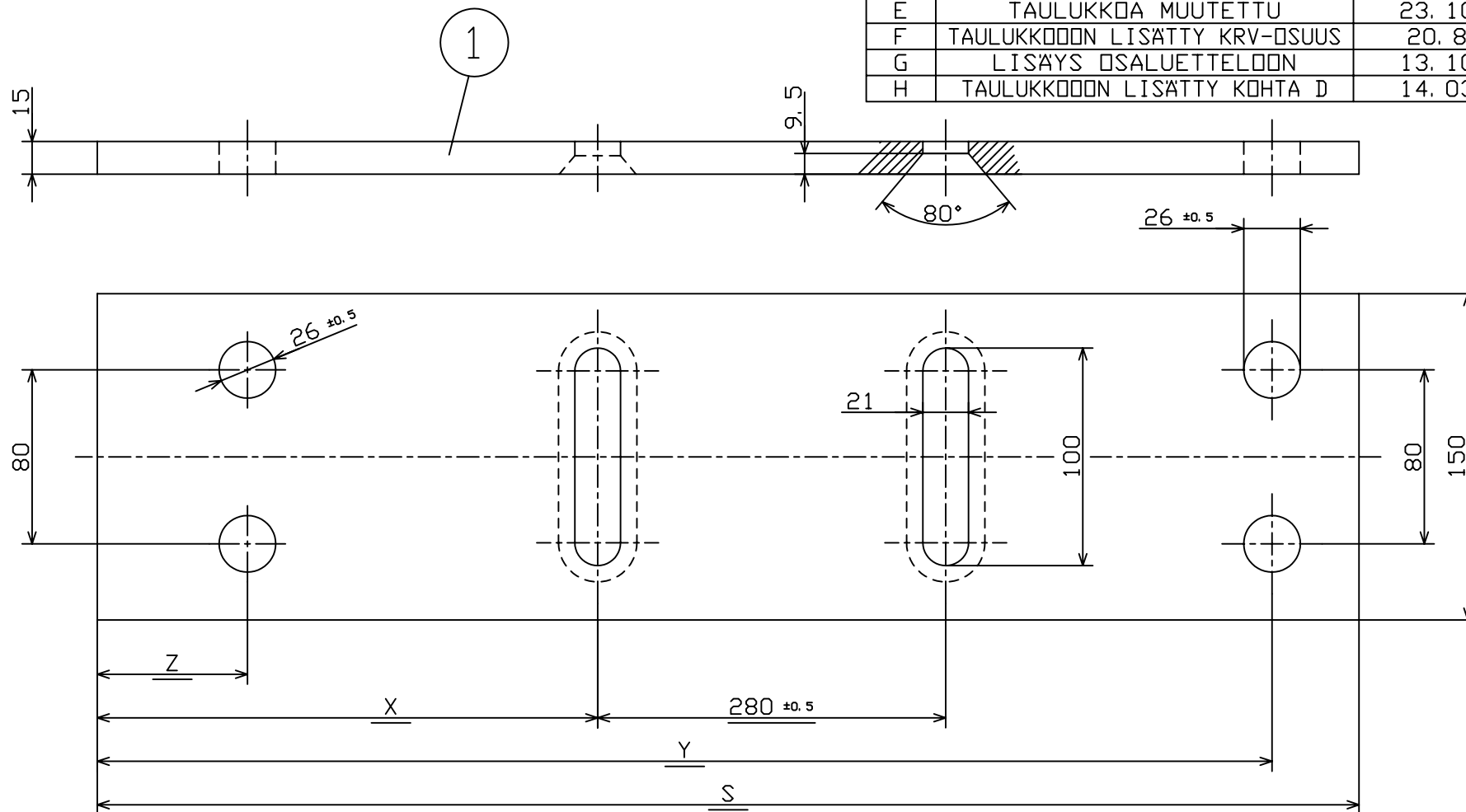


5	422D3922	PITKÄ TARKISTUSTANKO	1
4	422D3925	LYHYT TARKISTUSTANKO	1
3	422D3917	PITKÄ KÄYTTÖTANKO	1
2	422D3916	LYHYT KÄYTTÖTANKO	1
1		SÄHKÖKÄÄNTÖLAITE SIEMENS BSG. ANTR.	9 1

Osa	Tavara- tai piirustusnumero	Osan nimitys	Standardinro tai -luettelo	Muoto, malli, määrä	Laatu	Kpl
14	422E4110	SILMUKKARUUVI				1
13	422D4857	LYHYT TARK. TANKO, NIVELÖITY (KORVAA TARVITTAESSA OSAN 4)				1
12	422D4515	AURAUSSUOJA				1
11		RAIDERUUVI				12
10	422D4610	SÄÄTÖVIPU				1
9	422D4101	OPASTINLEVYN JALUSTA				1
8	422C4064	YKSINKERT. VAIHTEEN OPASTINLEVY				1
7	422D4852	ALUSLAATTA TAPA A, l=980				1
6	422D4851	ALUSLAATTA TAPA A, l=980				1

Yleistoleranssi					
Tuote		Liittyy	SÄHKÖKÄÄNTÖLAITTEEN SOVITUS VAIHTEESEEN YV60-300-1: 9-0 BETONIVAIHDEPÖLKYT		Suhde
YV60		4022-165-001			1: 10
Suunn.		28. 1. 91 PP	Ent. 421C4522E		Lehtiä
Piir.		28. 2. 91 AMA	CAD-PIIRUSTUS, HUOMIDI PRIVIIVIS		
Tark.			RATAYSIKKÖ		
Hyväks.			Paikka		Mk Numero
			4022142101_4522E		Muutos Lehti

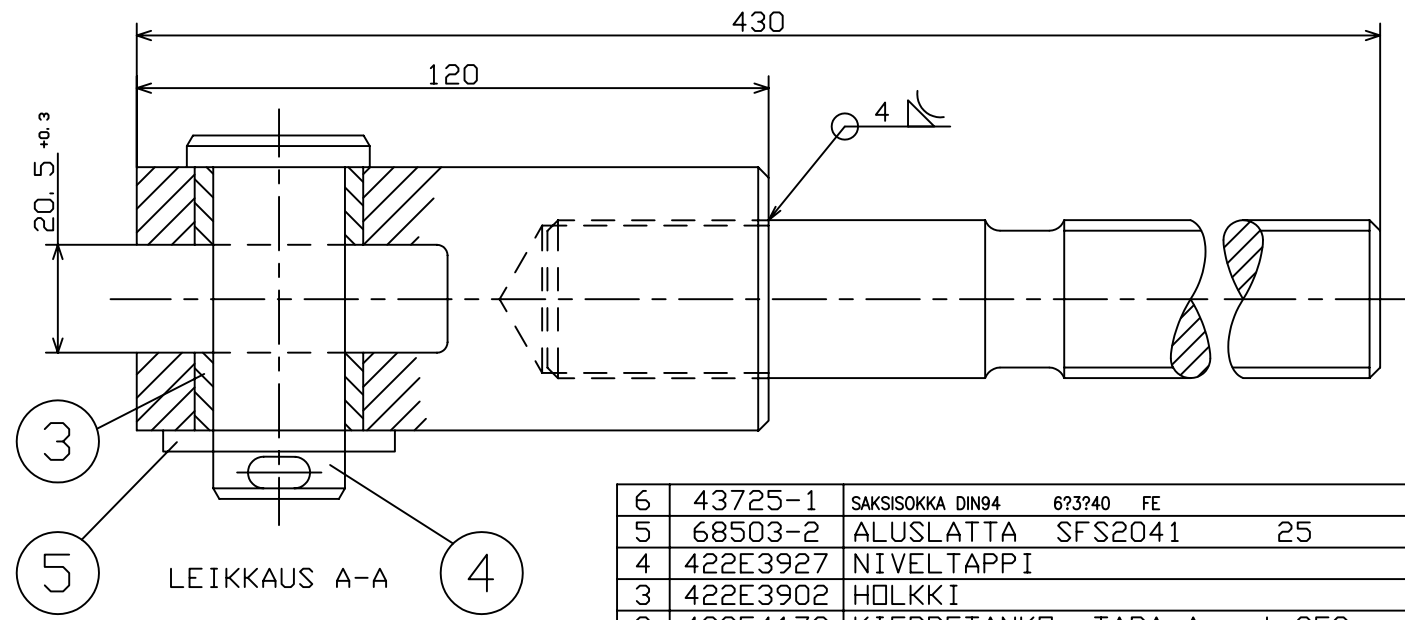
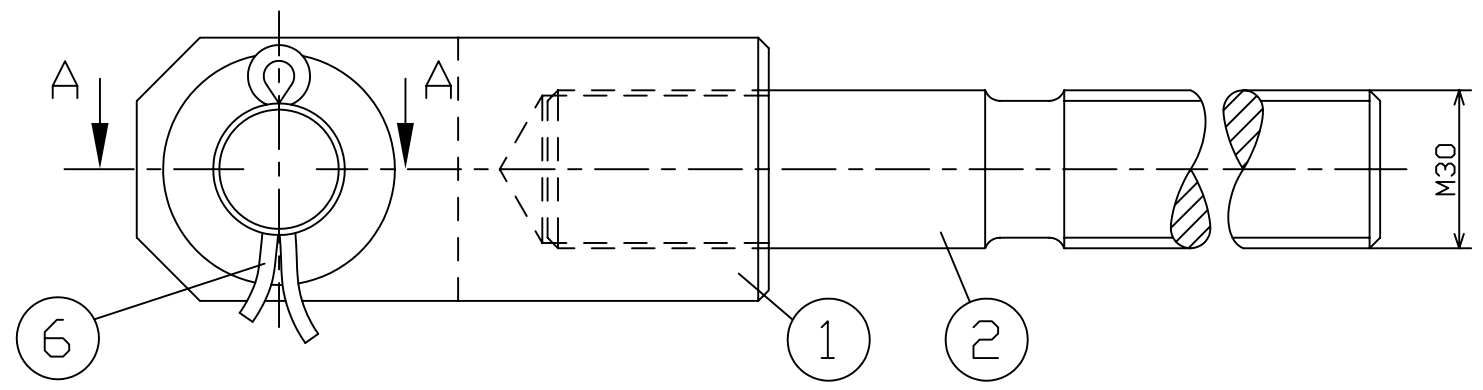
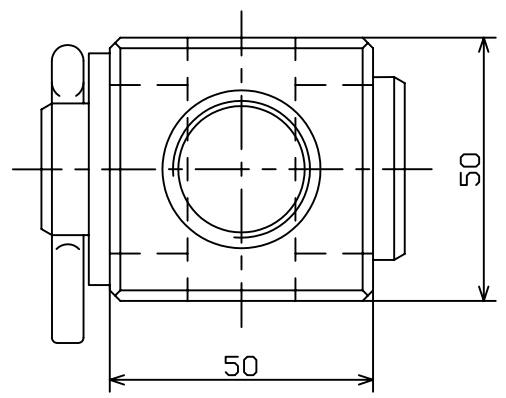
MERKKI	MUUTOS	PVM MUUTTANUT
C	UUSITTU MUUTOKSIN	4. 1. 93 AMA
D	TAULUKKOA MUUTETTU	5. 5. 93 AMA
E	TAULUKKOA MUUTETTU	23. 10. 95 AMA
F	TAULUKKODON LISÄTTY KRV-OSUUS	20. 8. 99 AMA
G	LISÄYS OSALUETTELOON	13. 10. 99 AMA
H	TAULUKKODON LISÄTTY KOHTA D	14. 03. 03 AMA



TAPA		Z	X	Y	S
A	1: 9 VAIHTEET	239	440	940	980
B	KÄRKIKÄÄNTÖL.	327	528	1038	1078
	KESKIKÄÄNTÖL.	327	528	1038	1078
C	KRV54	239	440	840	880
D	1: 9 VAIHTEET	239	440	940	1050

1		LATTATANKO SFS2022 150?15-S FE37B	1			
□sa	Tavara- tai piirustusnumero	Osan nimitys	Standardinro tai-luettelo	Muoto, malli, määrä tai-luettelo	Laatu	Kpl
Yleistoleranssi		Tuote		Liitty	Suhde	
				422D4851 422D4852 422D4853 422D4854 161-176	KIINNITYSLATTA 1: 2	
Suunn	2. 7. 92 PP	Ent.		422D4507G	Lehtiä	
Piirt	3. 7. 92 AMA	CAD-PIIRUSTUS, HUOMIOI PÄIVITYS				
Tark		RATAYKSIKKÖ		Paikka	Mk Numero	Muutos Lehti
Hyväks				4022	422D	4507H


MERKKI	MUUTOS	PVM MUUTTANUT
C	UUSITTU MUUTOKSIN	15. 12. 90 AMA



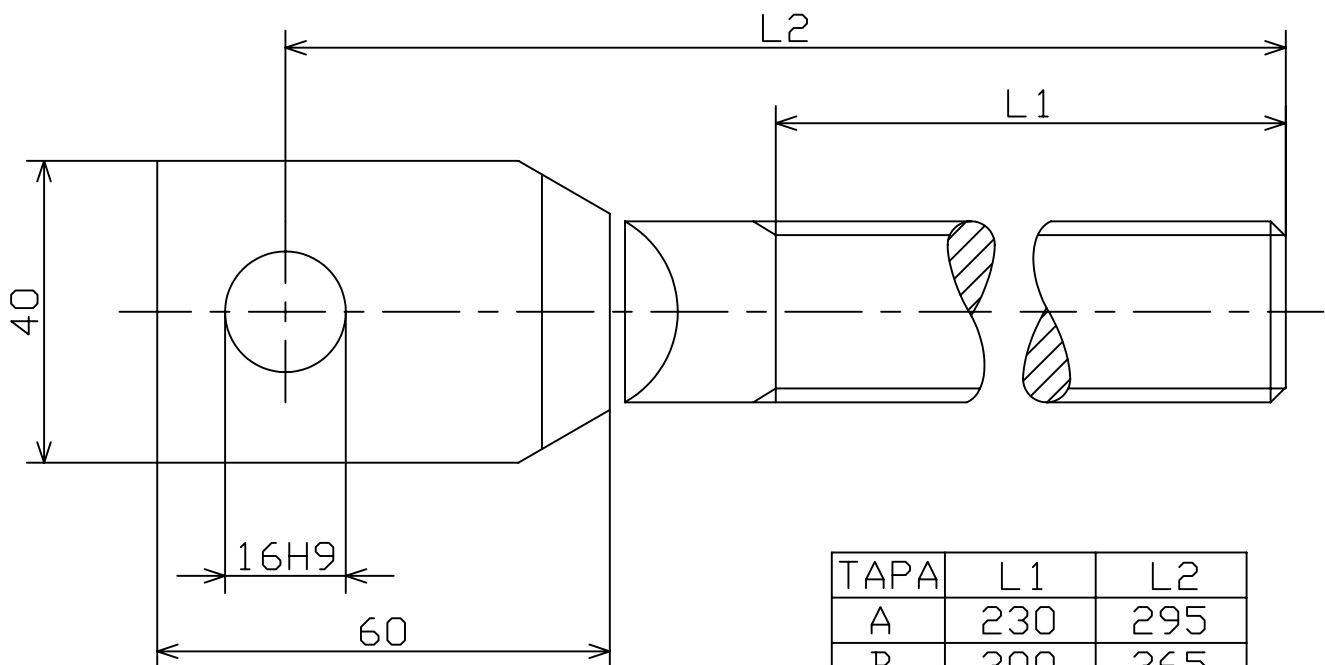
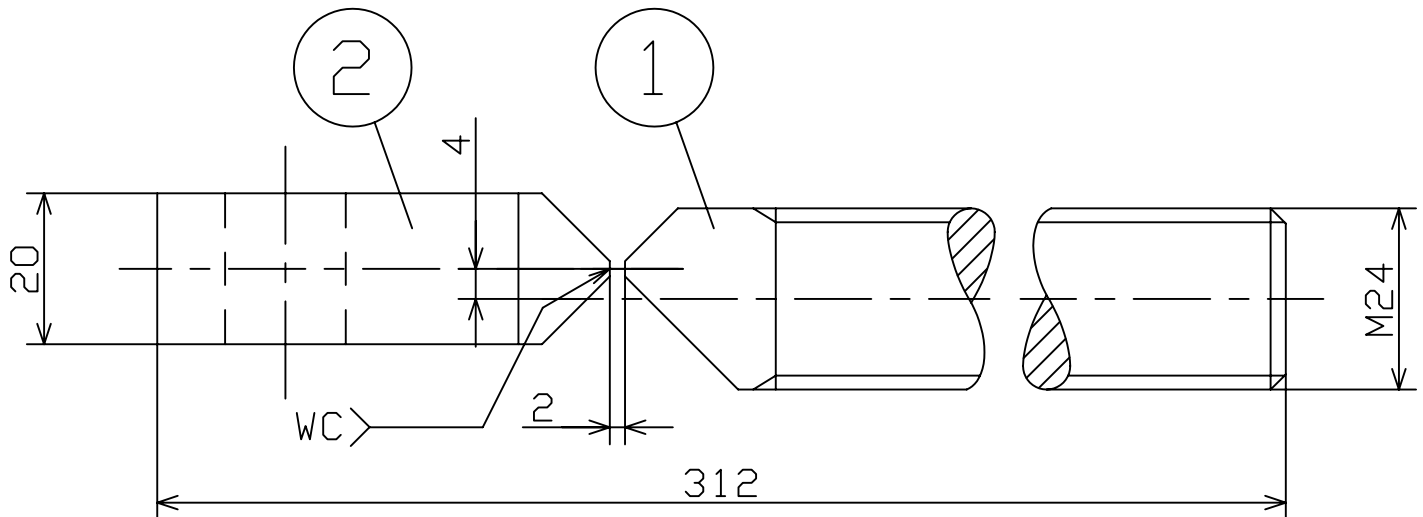
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5	68503-2	ALUSLATTA	SFS2041	25	ZNA2	1
4	422E3927	NIVELTAPPI				1
3	422E3902	HOLKKI				2
2	422E4178	KIERRETANKO TAPA A	l=350			1
1	422D3912	HAARUKKAKAPPALE 2				1

Osa	Tavara- tai piirustusnumero	Osan nimitys	Standardinro tai-luettelo	Muoto, malli, määrä tai-luettelo	Laatu	Kpl
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Yleistoleranssi					
Tuote		Liittyy		Suhde	
YV54		422D3916		KIERREPÄÄ 1	
YV43		422D3917		1: 1	

Suunn	11. 12. 90 PP		Ent.	422D3915B	Lehtiä
Piirt	15. 12. 90 AMA		CAD-PIIRUSTUS, HUOMIOI PÄIVITYS		
Tark		RATAYKSIKKÖ	Paikka	Mk Numero	Muutos Lehti
Hyväks			4022	422D	3915C

MERKKI	MUUTOS	PVM MUUTTANUT
B	UUSITTU MUUTOKSIN	21. 10. 92 AMA



TAPA	L1	L2
A	230	295
B	300	365

2	422E3920	KORVAKE	1			
1	422E3921	KIERRETANKO	1			
osa	Tavara- tai piirustusnumero	Osan nimitys	Standardinrol tai-luettelo	Muoto, malli, määrä Lajimerkki	Laatu	Kpl
Yleistoleranssi:						
Tuote		Liittyy	KIERREPA'A 2		Suhde	
YV54 YV43		422D3922 422D3925 422C4509 422C4510			1: 1	
Suunn	26. 11. 90 PP		Ent. 422E3919A		Lehtiä	
Piirt	30. 11. 90 AMA		CAD-PIIRUSTUS, HUOMIOI PAIVITYS			
Tark		RATAYKSIKKÖ	Paikka Mk Numero Muutos Lehti			
Hyväks			4022 422E 3919 B			

RHK:N TURVALAITEOHJEET

VAIHTENKÄÄNTÖLAITE + KOSKETIN

