FÉDÉRATION EUROPEÉNNE DU MODELISME AUTOMOBILE

Technical Regulations

2018

Revision 02

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PREAMBLE

Based on its Statutes the Fédération Européenne du Modélisme Automobile (FEMA) bears a special responsibility to promote and govern tether car racing. The following Technical Regulations, in conjunction with the Sporting Code, shall improve safety and establish equal terms of competition when conducting tether car racing.

The document is provided on the basis that all persons taking part in tether cars racing events participate at their own risk and undertake all necessary measures not to compromise safety. FEMA or its Executive Board members do not accept any liability to any person for the information (or the use of such information) which is provided in this document or incorporated into it by reference.

Every effort has been made to ensure that the information provided in this document is accurate. However, if you notice any errors or ambiguities, please let us know.

The FEMA Executive Board
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Note: All referenced forms are available as separate download at www.speedmodelcar.org

1. GENERAL

1.1. Scope

1. These regulations are mandatory and binding for all FEMA member countries.

1.2. Application

1. These regulations are to be used for all questions that may arise during FEMA sanctioned events. They are to be interpreted in such a manner that the original purpose is always maintained.
2. Should the regulations not cover a certain topic the FEMA board, the race jury and the race director must always decide in favor of the highest safety standard.

1.3. Safety

1. Model car: Every competitor is responsible for the technical safety of his or her model car. A yearly technical inspection and constant personal inspection of the model car are mandatory. Model cars that do not meet the technical regulations are not allowed to take part in FEMA races.
2. Tracks: Every organizer is responsible for the technical safety of the race track. A track is to be inspected every 3 years according to TR B3 Identified deficiencies must be resolved prior to the next FEMA race. Tracks that do not comply with safety standards must not host a FEMA race and will not be included in the official race calendar. Please also see TR 3.4.

1.4. Technical Delegate

1. Each country must designate a Technical Delegate and must be registered by name with FEMA. They will work together with the FEMA Technical secretary. The Technical Delegate will be responsible for ensuring that the FEMA regulations are upheld, and new regulations implemented in their country. He or she is also responsible for bringing new ideas to the FEMA Technical Secretary.
2. The Technical Delegate is responsible for the yearly model car approval for his country the results are to be stored by each Country delegate.

2. MODEL CARS

2.1. General

1. A model car must have four wheels and be powered by a combustion engine (piston engine). The transmission of power must occur directly or via a gearbox from the motor to one or more wheels.
2. The wheels must be arranged so that at the point of contact with the ground, either a rectangle or a trapezium is formed.
3. The car shall have two front wheels and two rear wheels. For the front wheels It is not required that the two wheels be rotated against each other. In a disassembled state, there must be two independent wheels.

2.2. Classes

1. The following are the prescribed race-classes:

Class	From (min.)	To (max.) Capacity
1	0.01 cm^3	1.5 cm^3
2	1.51 cm^3	2.5 cm^3
3	2.51 cm^3	3.5 cm^3
4	3.51 cm^3	5.0 cm^3
5	5.01 cm^3	10.0 cm^3

Table: Overview of Race-Classes

2. The maximum allowable deviation for all classes is an engine displacement of +0.009 cm^3.
3. Four stroke motors are allowable in all classes with double the engine displacement.
4. The relevant measuring points are the maximum diameter of the cylinder in TDC (1/100 mm) and the stroke (1/100 mm). The race director is responsible for having the required measuring devices and gauges at hand.

2.3. Weight

1. A car with all its components including fuel and batteries may not exceed the following weight in a ready state (including fuel, battery and electronics) at the start of a race:

Class	Maximum Weight
1	1.050 kg
2	1.570 kg
3	2.000 kg
4	2.300 kg
5	3.130 kg

Table: Overview of Maximum Weight / Class

2.4. Stability

1. Intrinsic load bearing and power transmitting components like the pan, bridle, motor and wheel mountings, axles etc., must be calculated in such a way that they safely meet the demands placed on them during operation.

2.5. Body

1. Body that together with the chassis encloses all parts with the following exceptions: Cylinder head (allowed up to 12 mm out of the body, Exhaust stinger, fuel shut off lever, vent connections for the fuel tank, needle valve, bridle, wheels. The body must be designed in such a way that the car can be stopped at any time without any risk of damage.

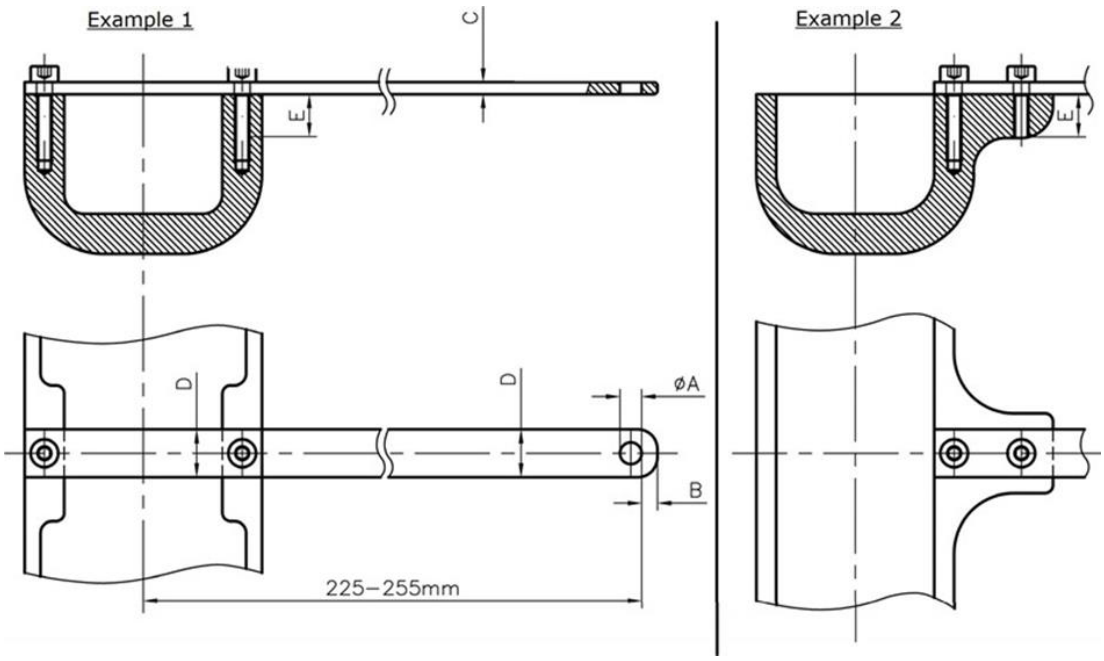
2.6. Bridle

1. Every car must be equipped with a bridle of material having a nominal tensile strength of 500 N/mm², for fastening the retaining cable. The minimum measurements shall be adhered to. The safety factor S=2 has to be applied for the strength calculation for the bridle and for the fixing screws of the bridle. The competitor shall ensure that the correct material has been used for the construction of the bridle.
2. Supplementary connectors between the bridle and the cable connector as well as wind shields or covers for the fastening elements are not allowed. Any aerodynamic cover used for the bridle must not extend beyond the length of the bridle and must not interfere with the fastening elements.
3. All bridles shall be marked on the outside at the screw hole for the correct cable colour with a colour mark of approximately 2 cm (either painted, or with coloured tape).

Classes	Colour
1	white
2	green
3	yellow
4	red
5	black

Table: Overview of the Colour markings for the bridle / class

4. All powered wheels must be symmetrically aligned with the centre of the car. The dimensioning of the bridle begins at this centre line. The minimum measurement of C and D must be clearly measurable in the area of the hanging and fastening holes. Otherwise the bridle may be profiled or wing-shaped as long as the minimum dimensions are respected. The rectangular CxD must be measurable. The crossover from profiled to right angled cross-section should have a radius of at least 3 mm. Countersunk screws shall not be used for fastening the bridle.
5. Bridles that are curved in the region of the flywheel must be checked for cracks. (see TR A1). If required, the bridle must be thermally treated in accordance with the material suppliers requirements (risk of breakage).



Example Illustration: Construction of the Bridle and Fasteners

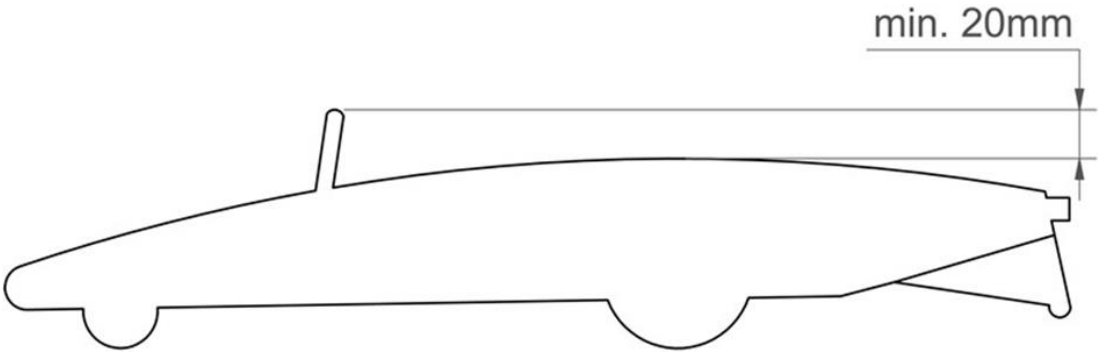
Class	A	B min.	B max	C min.	C max	D min.	E minimum screw length	min. 2 screws
1	4.5	2.0	4.0	2.0	3.5	8.5	9	M 3
2	4.5	2.5	4.0	2.0	3.5	9.5	9	M 3
3	5.5	3.0	4.0	2.5	4.5	11.5	12	M 4
4	5.5	3.0	4.0	2.5	4.5	11.5	12	M 4
5	5.5	3.5	4.5	4.0	4.5	12.5	15	M 5
Screw qualities: 8.8, no countersunk screws								
Free size tolerance according to DIN 7168 medium (all sizes in mm)								

Table: Dimensions for Bridle Illustration

Note: By the use of titanium for the manufacture of bridles, it is recommended that Titanium 6Al-4V (Grade 5) is the most widely used. This alloy was originally developed for light-weight and high strength applications in the aerospace market. Or a grade with similar properties.
When cold forming titanium a minimum bend radius of 5 time the thickness is recommended, this would generally be too big for our application.
The hot forging of titanium is a specialist process, but much tighter bend radius can be achieved. It is recommended that the material manufactures guidance on temperatures used, bend radius and potential material thickness reduction is followed.

2.7. Shutoff Device

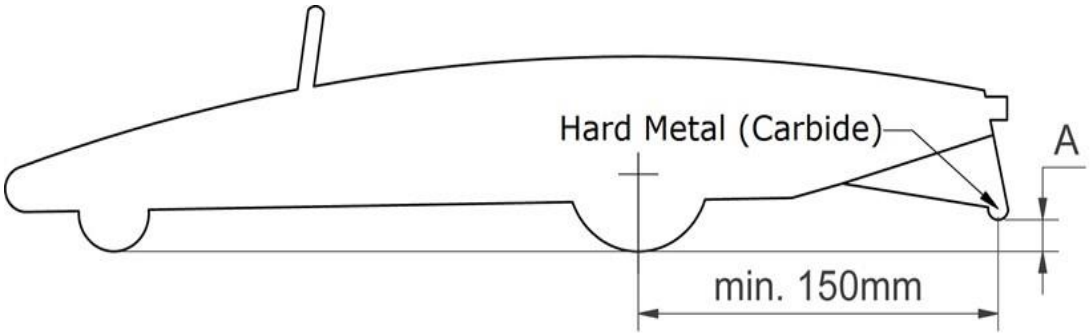
1. Every car must be equipped with a shutoff device, whose stop lever must project at least 20 mm in height above the highest point of the model in the on mode. So that the model can be stopped at any time and without difficulty. The spark, glow plug does not count as the highest point.



Example Illustration: Skid Integrated

2.8. Skid

1. Cars with rear wheel drive must be equipped with a skid that prevents the car from flipping. The end of the tail skid shall be hardened or made of carbide material (danger of injury). The skid shall not less than 150 mm long.
2. The tail skid must be firmly integrated into the chassis or bodywork. (No wire / No round steel). The maximum tail skid height (A) above the ground shall be maintained according to the classes: Class 1 = 20mm / Class 2, 3 = 25mm / Class 4 + 5 = 30mm.



Example Illustration: Skid Integrated

2.9. Electronics and Remote Control

1. Electronics inside the vehicle for controlling, regulating and measuring are allowed without restrictions.
2. An electronic remote control of the model from the outside is permitted within the 3 minutes of starting time. During the measurement period (8 laps) the model must not be influenced by remote control. After the measurement time, the model may be placed under remote control.

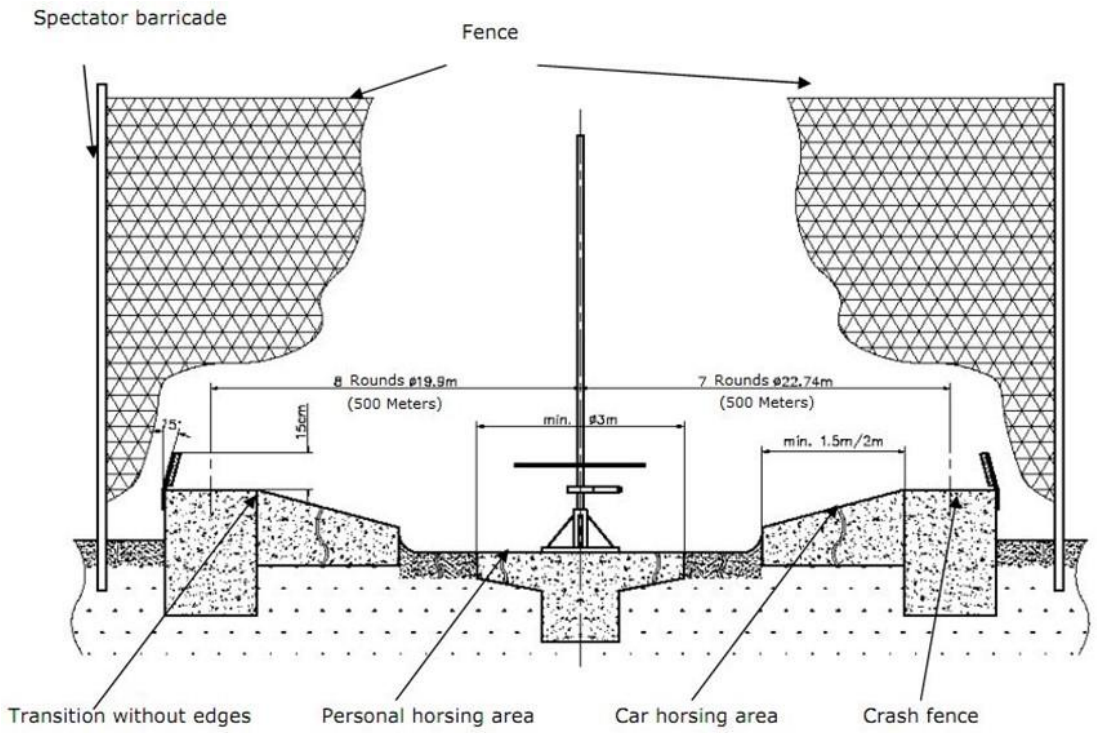
2.10. Model Identification Number

1. FEMA issues a four-digit Model Identification Number (MIN) which is unique for each car. The MIN must not be reused for further cars.
2. Allocation of a MIN may be requested by the General or Technical Delegate of the respective driver's country using Form F1. In order to complete the registration of a new car an initial safety inspection must be conducted according to Form F1 and submitted to FEMA.
3. The FEMA Model Identification Number (MIN) must be permanently marked on the main part of the chassis and clearly visible when the car is in a ready state. Recommended methods for applying the number are: burning-in, stamping and engraving.

3. RACE TRACKS

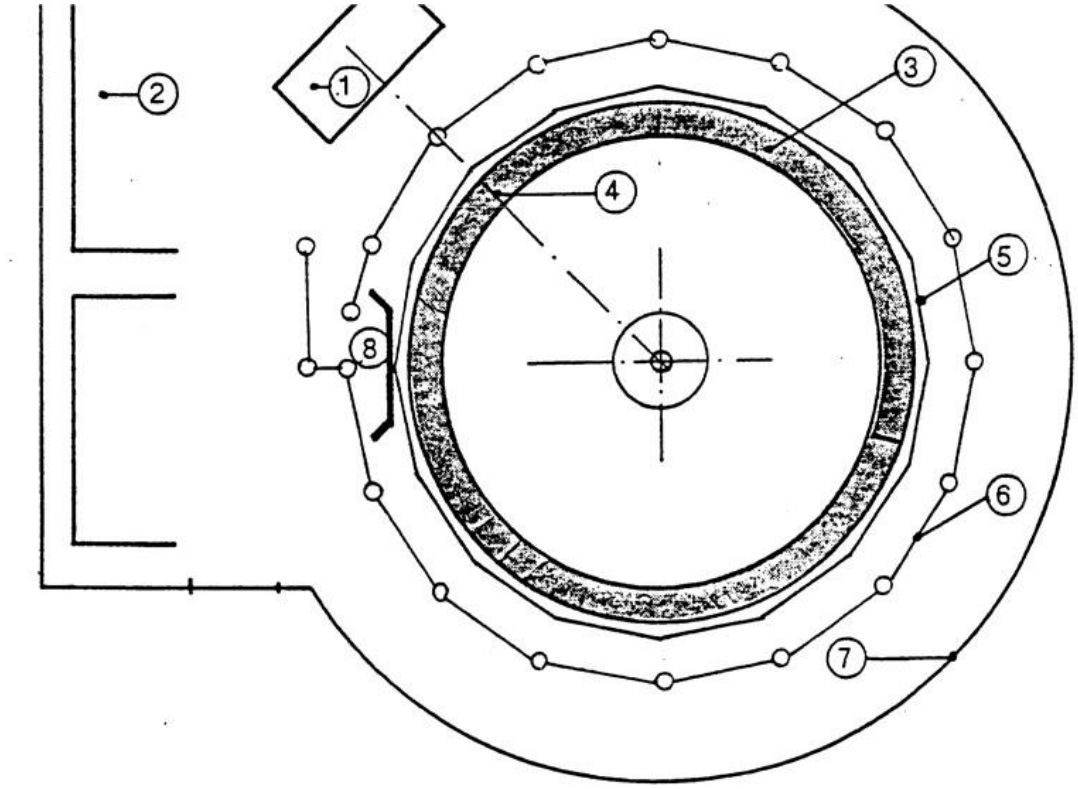
3.1. Track size

1. FEMA races must take place on flat horizontal round tracks. The cars must be attached to a cable coming from a post (centre post) in the centre of the track.
2. The prescribed track size is: 19.90m diameter = 8 laps - round track (500 m)
3. The race track shall have a minimum width of 0.35m. Inside of this must be an apron with a recommended width of 1m. For tracks constructed after 1985 the following minimum size for the apron shall 1.5m width.
4. In the centre of the track (at the centre post) there must be a flat concrete horsing area with a minimum diameter of 3m.



Example Illustration: Model Race Car Track (Sectional Drawing)

3.2. Infrastructure

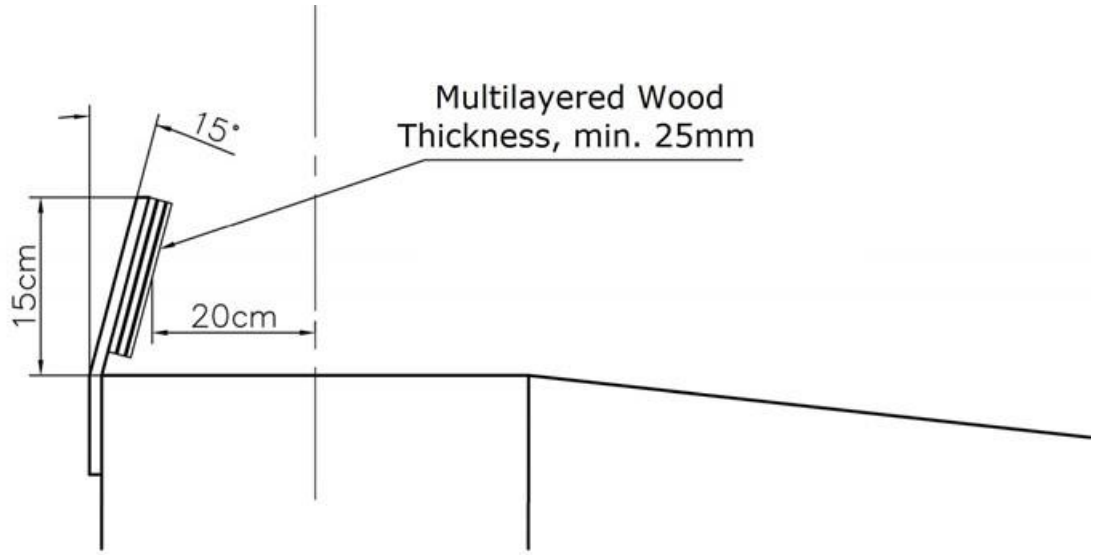


Sample drawing of a racetrack

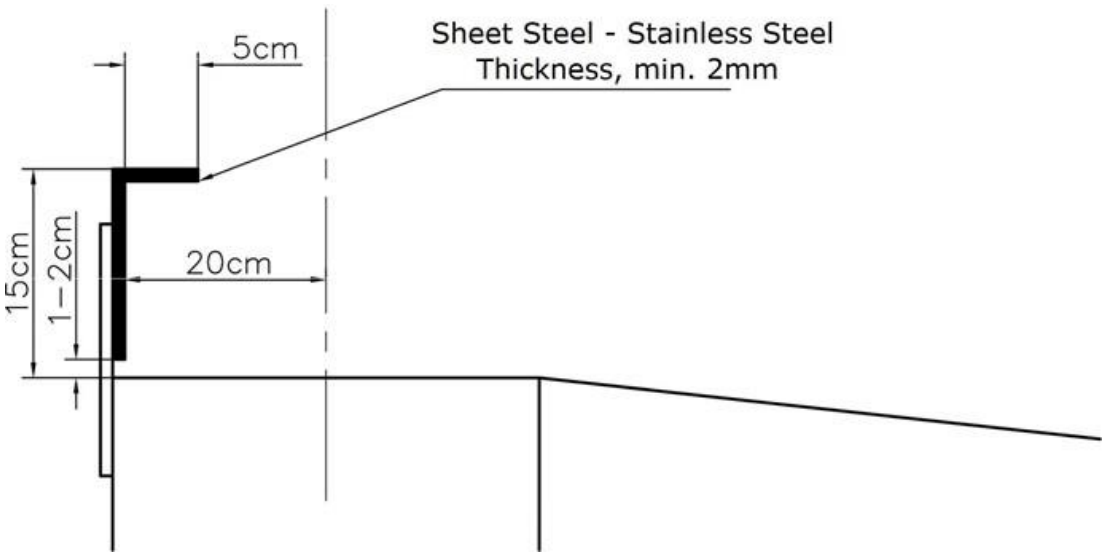
1. Timekeeper's house
2. Participant's area
3. Track
4. Timing mark
5. Safety barrier
6. Safety fence
7. Spectator barricade
8. Driver's station

3.3. Safety devices

1. In order to protect against model cars flying off the track, the track must be equipped with a solid safety barrier. The barrier must be made of layered wood with a minimum thickness of 25 mm or of stainless steel plate with a minimum thickness of 2 mm. The inside of the wall should be smooth and have no protruding screws or supports. The barrier cannot be more than 20 cm away from the model. The gap between the barrier and the track surface should be not less than 1 cm and not more than 2 cm. Wooden safety barriers must be replaced every 10 years.



Example Illustration: Wooden safety barrier



Example Illustration: Stainless safety barrier

2. For the safety of drivers and spectators, the track must have double safety fencing to provide protection against parts of a car coming off during a run. For this purpose a protective textile, polycarbonate sheet, PVC sheet of at least 0.5mm thickness or a comparable material has to protect the whole circumference of the track area from ground up to 1m in height. At least ¼ of the track after the shutoff device, and areas

where spectators or participants observe the race. The protective textile, polycarbonate sheet, PVC sheet of at least 0.5mm thickness shall be head height. FEMA race organizers must ensure that drivers and spectators stay at least 1m away from the fence. Exemptions for race tracks with deviating, but at least similar effective safety features (e.g. brick-built walls) have to be examined on a case-by-case basis and require documentation in Form F2 during safety inspection.

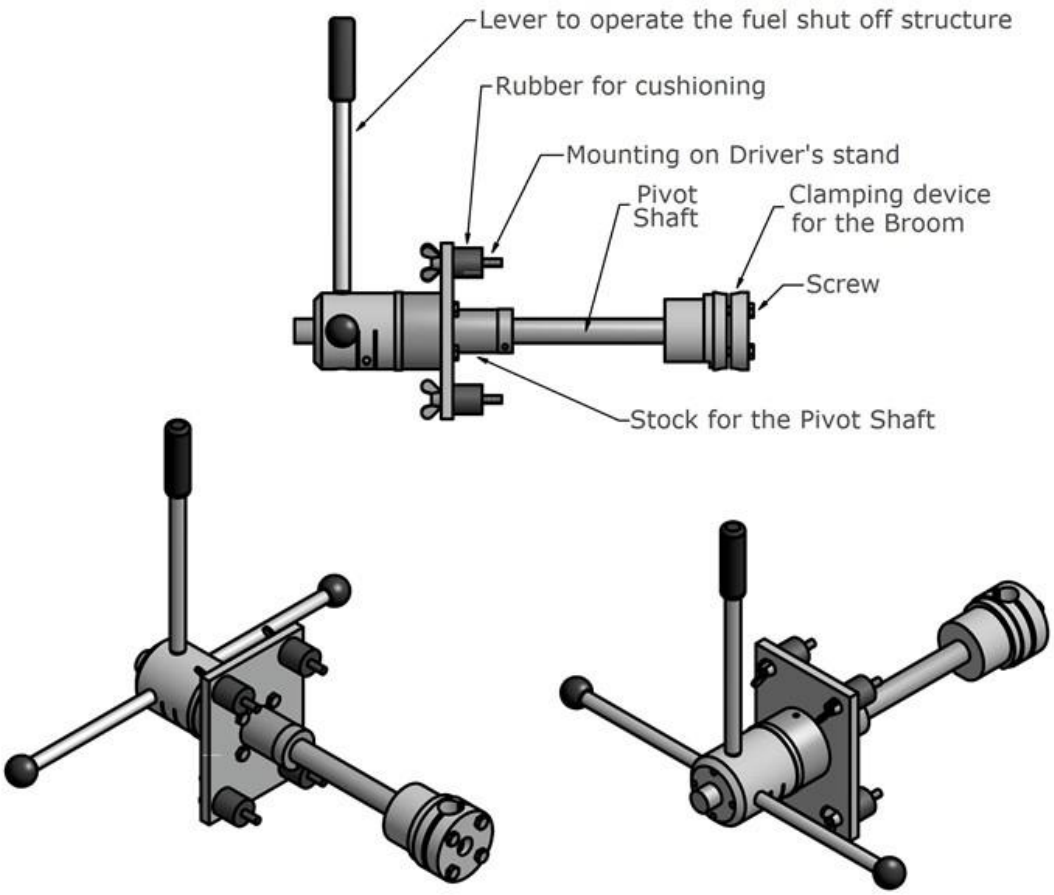
3. There must be a safe and secure driver's station. It must offer protection from the front and both sides (safety wall, safety glass, doors). The driver's station must offer adequate protection when cars are racing both clockwise and counter clockwise.
4. Cars that crash into the safety barrier or fence after a break in the cable will cause damage to the wall or fence. The damage is dangerous to both the spectators and the drivers. Organizers are responsible for replacing or fixing dented and damaged fences and barriers before the next run.

3.4. Testing of Protective Devices

1. As described in TR 1.3, FEMA requires all race tracks to be inspected every 3 years according to Form F2 All safety features mentioned in Form F2 have to be documented with corresponding pictures. The timely inspection shall be the duty of the track owner and race organizer.
2. It is a requirement of the race organizer to check all safety features prior to a FEMA race, and to repair any defects immediately. FEMA has to be informed about any alteration to the installed safety features immediately and prior to the next race.
3. Form F2 corresponding pictures or a report on alterations have to be sent to the General Secretary and Technical Secretary.

3.5. Shut-off device

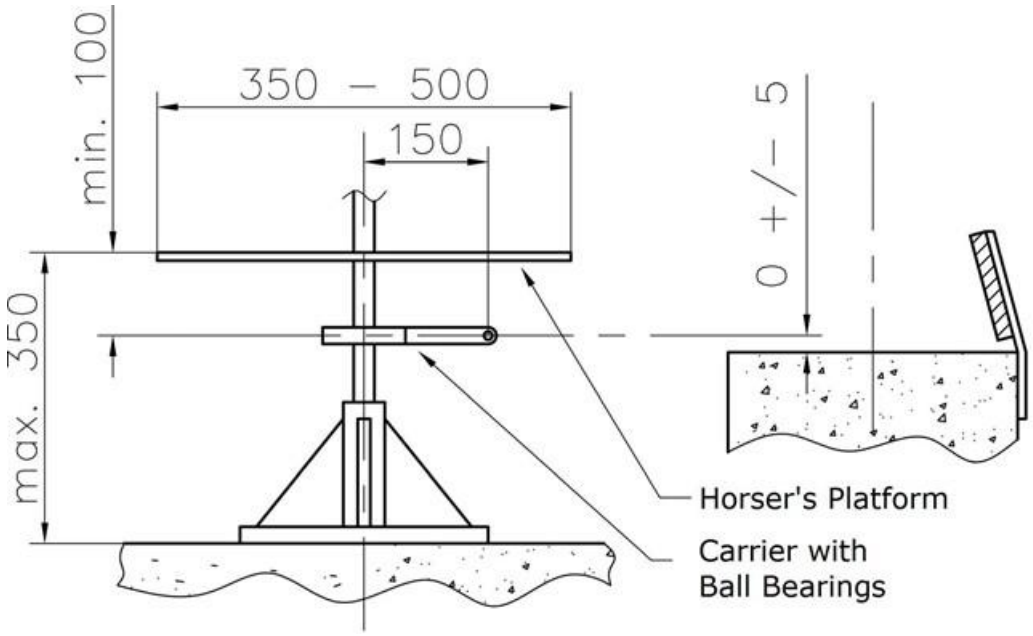
1. Each race track has to be equipped with a fixed shutoff device, which is used for all training and timed runs. The broom used as shutoff device has to pivot. The pivot should be 80cm or higher above the track surface. The shutoff device must be operated via a lever outside the track area within the driver's stand. A shutoff device lowering the broom perpendicular to the track is not allowed.
2. The broom must be set to a minimum height of 20mm above the bridle for every racing class. The bristles of the broom should be equal in length. The setting and condition should be checked after each run of a model by the cable marshal and the competitor.
3. Instead of a broom, a mop with viscose/cellulose strips is also recommended.
4. Only in an emergency situation small hand brooms (maximum total length: 100cm) may be used to stop the model manually. Brooms with longer handles are not allowed, if a hand broom is used for stopping the model car, the run is invalid.



Example Illustration: Mechanism of the Shut-Off Device

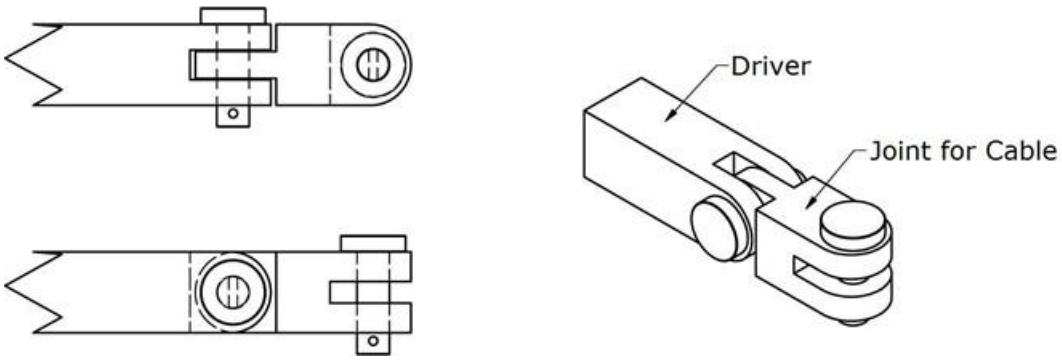
3.6. Centre post

1. The centre post must be solid, securely anchored and be equipped with a ball race mounted carrier for the cable attachment. The dimension of the centre of the centre post to the middle hole for the cable attachment to the carrier must be 150mm, 0/+2.
2. The centre post must be provided with a platform for the horser, which has a diameter of 350 to 500mm.
3. The vertical distance between the cable fastening on the attachment and the running surface of the track must be 0 +/- 5 mm.



Example Illustration: Driver's Centre Post

4. Attachment with joint: Pin d= 5mm, Material: Hexagon Socket Screw, grade 12.9.



Example Illustration: Attachment/Driver Joint

5. Centre posts are subject to wear from the turning of the horser and can break. Before the start of each season the centre post should be inspected in accordance with TR A1.
6. It is recommended for the centre post to be anchored (wired) to three points from above.

3.7. Timekeeping System

1. The timing at FEMA races must be performed by at least two reliable and independently operating systems. The timing system must measure the lap time with a precision of one millisecond or higher and record the lap number and measured speed.

4. CABLE

4.1. General

1. The tethering cable for the guidance of the model car on the track (hereafter referred to as, cable) must be produced using non-alloyed, round spring steel in accordance with DIN EN 17223 or made of carbon, round spring steel to EN10270-1 .

   Note: The old descriptions "Extra" (DIN 17223, from 1944 - 1964) and Class 2 (DIN 17223, 1964 - 1984) are still allowed by vendor specification. Suitable alternative materials having a tensile strength of R = 2470 - 2500 N/mm² may be used. The wire type "D" must be used for the production of the cable

2. It is not permitted to use wires with rust or corrosion marks.
3. The cable and all its fastening elements belong to the race track. The enclosure, change or covering of any part is not permitted.

4.2. Allowable tension

1. The following equation is used for determining the maximum allowable tension:

$$\frac{d^2 \times \pi}{4} \times Rm = d^2 \times 0.785 \times Rm \ \ (N)$$

d = Diameter of Wire
Rm = Minimum (according to TR A4)

Note: A correction factor for the cable ends is not necessary. The weakest point is clearly the simple cable cross-section.

2. The following table shows the tensile strength of the finished cable, depending on the wire diameter:

Wire Diameter (mm)	Tensile Strength (N)
0.80	1160
0.90	1443
1.00	1750
1.10	2089
1.20	2452
1.30	2839
1.40	3246
1.50	3691
1.60	4139
1.70	4628
1.80	5137
1.90	5667
2.00	6217
2.10	6819

Table: Overview of the tensile strength of cables according to diameter.

3. To calculate the tensile loads, one must account for the allowed maximum permissible weight of the model car and include the following supplement for the shackle:

Class	Maximum Car Weight	Supplement	Total Weight (G)
1	1.050 kg	0.030 kg	1.080 kg
2	1.570 kg	0.040 kg	1.610 kg
3	2.000 kg	0.075 kg	2.075 kg
4	2.300 kg	0.075 kg	2.375 kg
5	3.130 kg	0.100 kg	3.230 kg

Table: Shackle weight

4. The tensile load (Centrifugal Force) (F) in N is calculated as follows:

$$F = \frac{V^2}{R} \times G \ (N)$$

V = Speed in m/sec.
R = Track radius in meters (according to TR 3.1.2 = 9.95 m).
G = Weight of model racing car in kg.

4.3. Safety factors

1. A safety factor of S = 2 shall be used to calculate the required cable diameter.
2. For light damage to the cable, for example, scratches from the concrete of the track. A deduction of 2% of the maximum speed is to be taken into account. This calculated value is rounded down to an integer.

4.4. Maximum speed

1. The maximum permissible speed (v) for each class and for each wire diameter is calculated to the tensile strength values found in TR 4.2.2 and the formula from TR 4.2.4.

$$v = 3.6 \times \sqrt{\frac{R \times C}{2 \times G}} \ (km/h) \ -2\%$$

R = Track radius in meters (according to TR 3.1.2. = 9.95 m).
C = Tensile strength according to TR 4.2.2.
G = Weight of the model car in kg according to TR 4.2.3

4.5. Maximum Speed for Class/Cable

1. The allocation of cables to the different classes as well as the allowed maximum speed for the different cable diameters are shown in the following table:

Class	Cable Diameter (mm)	Allowed Maximum Speed
1	0.90	287 km/h
	1.00	316 km/h
2	1.20	307 km/h
	1.30	330 km/h
3	1.40	311 km/h
	1.50	331 km/h
4	1.60	328 km/h
	1.70	347 km/h
5	2.00	345 km/h
	2.10	361 km/h

Table: Overview Class / Cable Diameter / Maximum Speed

2. If the maximum allowable speed is reached or exceeded during a FEMA race, the next thickest cable shall be used (see SC 4.2)
3. The maximum speed in each case is the average speed of 8 timed rounds.
4. The graduation of the cable diameters for the next higher speed limit occurs in steps of 0.1 mm for all classes.

4.6. Cable ends

1. The cable ends are to be made according to the technical directives from TR A2. The windings must be done carefully so that the cable is not damaged during the procedure. The cable ends must be colour coded as follows:

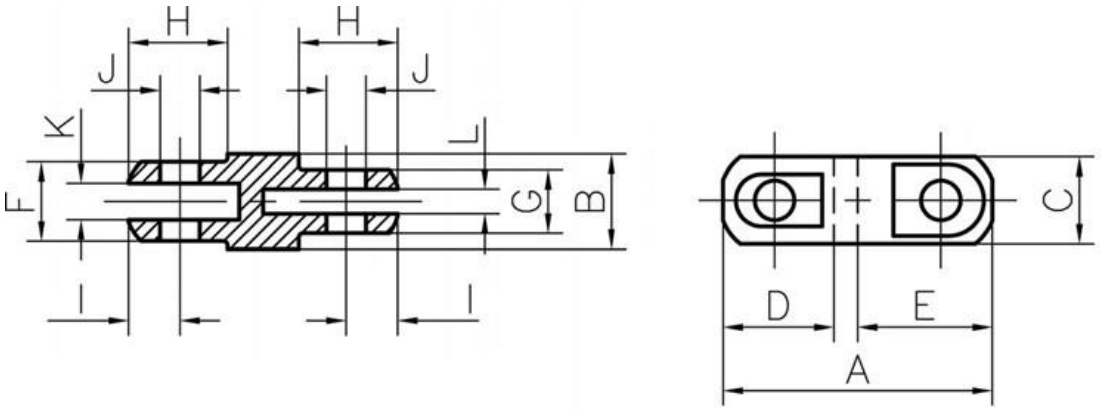
Class	Colour
1	White
2	Green
3	Yellow
4	Red
5	Black

Table: Overview of the cable colour by class.

2. Each cable must be provided with a label on the inner thimble with the date of manufacture, the diameter, and the tested tension load (in accordance with TR A2).

4.7. Fastening elements

1. The fastener (Centre Post to Cable) must be made in accordance with TR 3.6. The fasteners (Cable to bridle) must be carried out as follows:

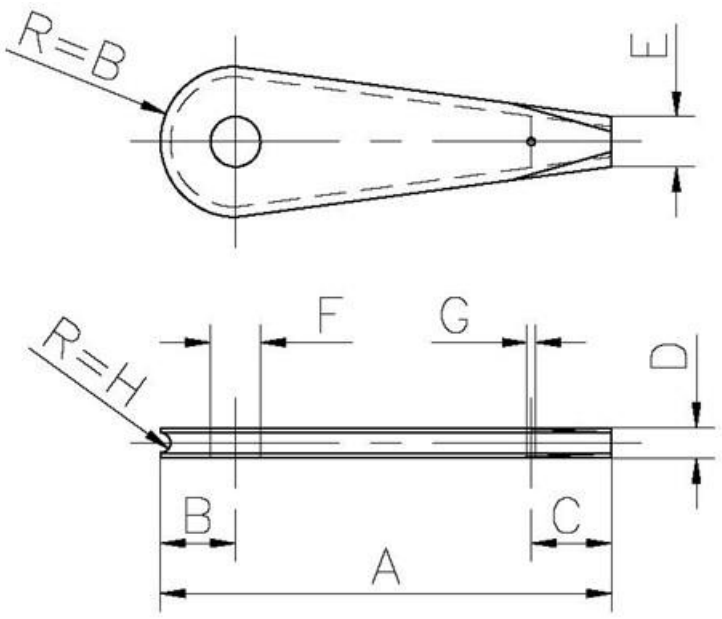


Example Illustration: Fastener, Cable to Bridle.

Designation	Class	Size
A	1 / 2 /	25.0 mm
	3 / 4 / 5	34.0 mm
B	1 / 2 /	10.0 mm
	3 / 4 / 5	12.0 mm
C	1 / 2 /	9.0 mm
	3 / 4 / 5	11.0 mm
D	1 / 2 /	11.5 mm
	3 / 4 / 5	14.0 mm
E	1 / 2 /	11.5 mm
	3 / 4 / 5	17.0 mm
F	1 / 2 /	7.6 mm
	3 / 4 / 5	10.0 mm
G	1 / 2 /	6.1 mm
	3 / 4 / 5	8.0 mm
H	1 / 2 /	10.0 mm
	3 / 4 / 5	12.5 mm
I	1 / 2 /	5.0 mm
	3 / 4 / 5	6.5 mm
J	1 / 2 /	4.0 mm
	3 / 4 / 5	5.0 mm
K	1 / 2 /	3.6 mm
	3/ 4 / 5	4.6 mm
L	1 / 2 /	2.1 mm
	3 / 4 / 5	3.1 mm

Table: Fastener, Cable to Bridle.

4.8. Cable termination (thimble)



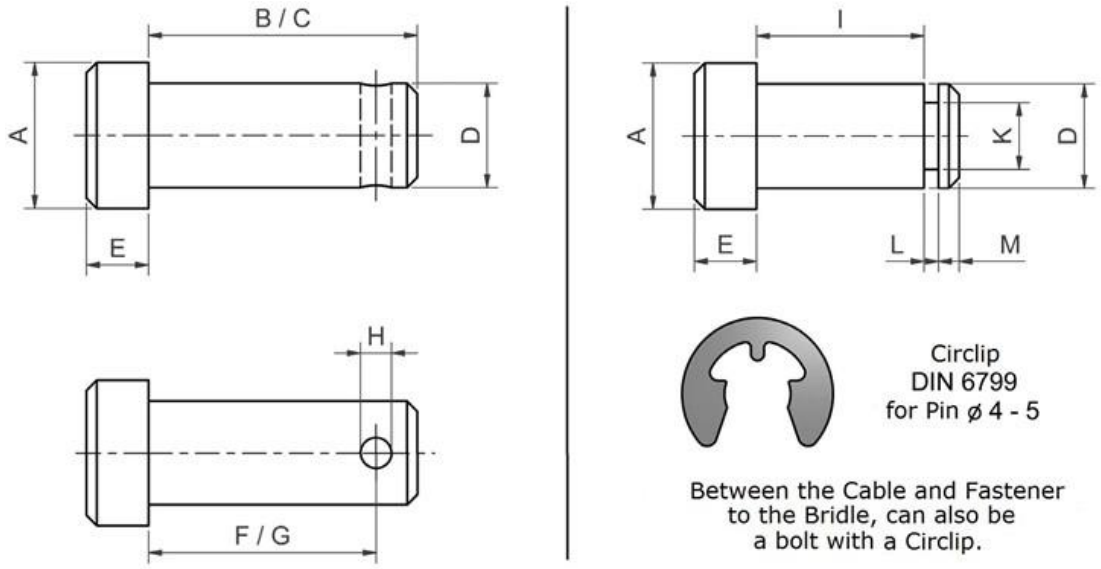
Example Illustration: Cable Termination (Thimble)

Designation	Class	Size
A	1 / 2 /	33.0 mm
	3 / 4 / 5	45.0 mm
B	1 / 2 /	5.0 mm
	3 / 4 / 5	7.5 mm
C	1 / 2 /	6.0 mm
	3 / 4 / 5	8.0 mm
D	1 / 2 /	2.0 mm
	3 / 4 / 5	3.0 mm
E	1 / 2 /	3.0 mm
	3 / 4 / 5	5.0 mm
F	1 / 2 /	5.0 mm
	3 / 4 / 5	5.0 mm
G	1 / 2 /	0.8 mm
	3 / 4 / 5	0.8 mm
H	1 / 2 /	0.75 mm
	3 / 4 / 5	1.0 mm

Table: Measurements on sample drawing of the thimble above.

Material: Brass MS 58, SIS 5165-4
Safety recommendation: Usage of large thimble on the post side of the cable also for the classes 1, 2.

4.9. Pin



Example Illustration: Pin

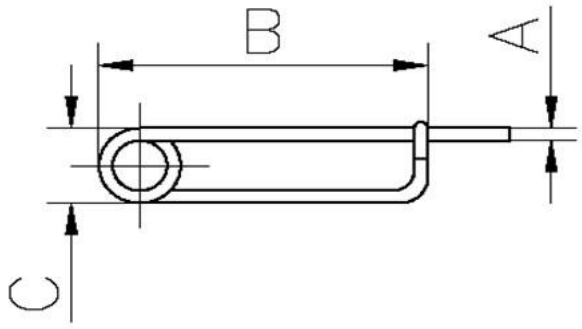
Designation	Class	Size
A	1 / 2 /	7.0 mm
	3 / 4 / 5	7.0 mm
B	1 / 2 /	9.0 mm
	3 / 4 / 5	11.0 mm
C	1 / 2 /	11.0 mm
	3 / 4 / 5	13.0 mm
D	1 / 2 /	3.9 mm
	3 / 4 / 5	4.9 mm
E	1 / 2 /	2.0 mm
	3 / 4 / 5	3.0 mm
F	1 / 2 /	7.0 mm
	3 / 4 / 5	9.0 mm
G	1 / 2 /	8.5 mm
	3 / 4 / 5	11.0 mm
H	1 / 2 /	1.5 mm
	3 / 4 / 5	1.5 mm

Table: Measurements on sample drawing of the pin above.

Material: Cap Screw with hexagon socket quality 12.9

4.10. Safety clip

1. The Pin must be secured with a Safety Clip:



Example Illustration: Safety Pin

Designation	Class	Size
A	1 / 2 /	0.6 mm
	3 / 4 / 5	0.6 mm
B	1 / 2 /	20.0 mm
	3 / 4 / 5	24.0 mm
C	1 / 2 /	6.0 mm
	3 / 4 / 5	6.0 mm

Table: Measurements for sample illustration, Safety Pin.

Material: Same material as used for the cable

4.11. Cable testing

1. Before international and FEMA sanctioned races all cables must be tested in accordance with the test directives and test loads for every cable size. The test load = 50% of the minimum tensile stress at break.

D (mm)	Tensile Stress At break (N)	Test Load (N)	Test Load (kg)
0.90	1443	722	74
1.00	1750	875	89
1.10	2089	1044	107
1.20	2452	1226	125
1.30	2839	1414	145
1.40	3246	1623	166
1.50	3691	1845	188
1.60	4139	2069	211
1.70	4628	2314	236
1.80	5137	2568	262
1.90	5667	2833	289
2.00	6217	3108	317
2.10	6819	3409	348

Table: Summary of Test Load.

2. For 8 lap tracks the cable must have a length of 9.725 - 9.745m at 10% of the test load from the centre post to the centre of the outside shackle pin.
3. For 7 lap tracks the cable must have a length of 11.145 - 11.165m at 10% of the test load from the centre post to the centre of the outside shackle pin.

4.12. Cable replacement

1. Cables must be replaced every 4 years.

ANNEX

A1 - Technical instructions: Checking of centre post

A2 - Technical instructions: Manufacturing of cable ends

A3 - Technical instructions: Cable testing equipment

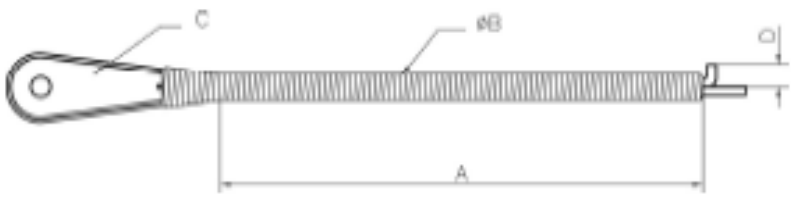
A4 - Data sheet: Tensile strength of the cable

A1 - Technical instructions: Checking of centre post

The centre post can be bent by the Horser and this may cause failure of the post. Before start of the season is the centre post is to be examined using a suitable crack detection dye penetrant system. The dye penetrant manufactures instruction are to be followed.

The results for every annual crack detection shall be kept (by the race director) and a copy sent to the Technical Secretary of FEMA.

A2 - Technical instructions: Manufacturing of cable ends



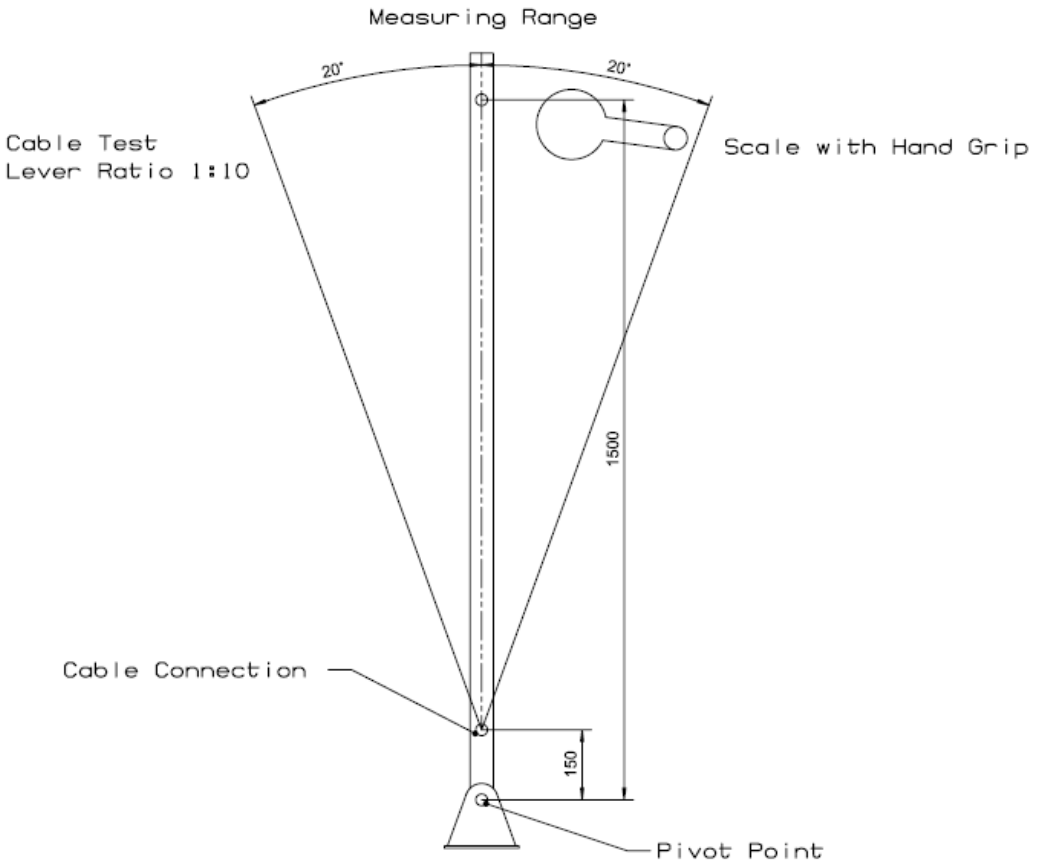
Example Drawing: Cable end

Class	Dimension A mm	Ø B mm	Dimension C(LxBxH) mm	Dimension D mm
1	40	0.4	33 x 10 x 2	3^{+2}
2	60	0.4	33 x 10 x 2	3^{+2}
3	80	0.5	33 x 10 x 2	3+2
4	80	0.5	45 x 15 x 3	3+2
5	100	0.5	45 x 15 x 3	3+2

Table: Overview of the mass for the production of cable

- Clean the wire ends, roughen with emery cloth and degrease with acetone. Attention: The temperature of the solder bath affects the Hardness and thus the strength of the wire. Use only a solder alloy with the 60/40 Sn / Pb (185 ° C) or 50/50Sn / Pb (200 ° C). The solder bath should not exceed 230 ° C.
- **Very Important:** tin-dip the wire end before bending over 300 to 400mm.
- Wire bending around a mandrel and fit to the thimbles.
- Align wire end parallel to the wire.
- Starting at the 1 mm Ø hole in the thimble, wrap round with binding wire, must lie coil on coil wire to the end.
- Bend wire end bend up and achieve dimension D.
- Dip the completed cable end in the solder bath.
- Clean tinned cable ends thoroughly with soapy water.
- Stamp the thimble with the date of manufacture and Test load. Month, year and Kg, e.g. 05.2011 / 216kg
- Mark outside of the cable with color.
- Cable spray with rust preventive oil.
- Check completed cable.

A3 - Technical instructions: Cable testing equipment



Example Drawing: Cable test lever 1:10

- The scale should have a load capacity of 50 kg and divisions of 200g in order to read as precisely as possible.
- The balance must always perpendicular to the bar while loading stand, otherwise leads to large measurement errors.
- The wire test loads must never be exceeded. Apply the test load slowly and steadily.

Wire Ø	Reading (kg)	Wire Ø	Reading (kg)
0.9	7.4	1.6	21.1
1.0	8.9	1.7	23.6
1.1	10.7	1.8	26.2
1.2	12.5	1.9	28.9
1.3	14.5	2.0	31.7
1.4	16.6	2.1	34.8
1.5	18.8		

Table: Test load for cable

A4 - Data sheet: Tensile strength of the cable

Steel wire for springs patented- drawn, unalloyed (Exert from DIN 17223 part 1 1984-12)

Mechanical Properties							
Wire diameter d			Weight kg/1000m	Tensile strength Rm for wire locations			
	Permissible deviations according to DIN 2076 for the types of wire			A	B	C	D
mm	A and B mm	C and D mm	≈	N/mm²	N/mm²	N/mm²	N/mm²
0.50	± 0.020	± 0.010	1.54		2200-2470		2480-2740
0.53			1.73		2180-2450		2460-2720
0.56			1.93		2170-2430		2440-2700
0.60			2.22		2140-2400		2410-2670
0.63			2.45		2130-2380		2390-2650
0.65			2.60		2120-2370		2380-2640
0.70			3.02		2090-2350		2360-2610
0.75			3.47		2070-2320		2330-2580
0.80			3.95		2050-2300		2310-2560
0.85	± 0.025	± 0.015	4.45		2030-2280		2290-2530
0.90			4.99		2010-2260		2270-2510-
0.95			5.59		2000-2240		2250-2490
1.00			6.17	1720-1970	1980-2220		2230-2470
1.05			6.80	1710-1950	1960-2200		2210-2450
1.10			7.46	1690-1940	1950-2190		2200-2430
1.20			8.88	1670-1910	1920-2160		2170-2400
1.25			9.63	1660-1900	1910-2140		2150-2380
1.30			10.42	1640-1890	1900-2130		2140-2370
1.40			12.08	1620-1860	1870-2100		2110-2340
1.50	± 0.035	± 0.020	13.9	1600-1840	1850-2080		2090-2310
1.60			15.8	1590-1820	1830-2050		2060-2290
1.70			17.8	1570-1800	1810-2030		2040-2260
1.80			20.0	1550-1780	1790-2010		2020-2240
1.90			22.3	1540-1760	1770-1990		2000-2220
2.00			24.7	1520-1750	1760-1970	1980-2200	1980-2200
2.10			27.2	1510-1730	1740-1960	1970-2180	1970-2180
2.25			31.2	1490-1710	1720-1930	1940-2150	1940-2150
2.40			35.5	1470-1690	1700-1910	1920-2130	1920-2130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