

Control cables for motorcycles

1. Scope

This standard specifies the control cables for motorcycles and motorbikes (hereinafter referred to as "cables") mainly used for tension control.

Remark: Applicable standards for this standard are shown as follows:

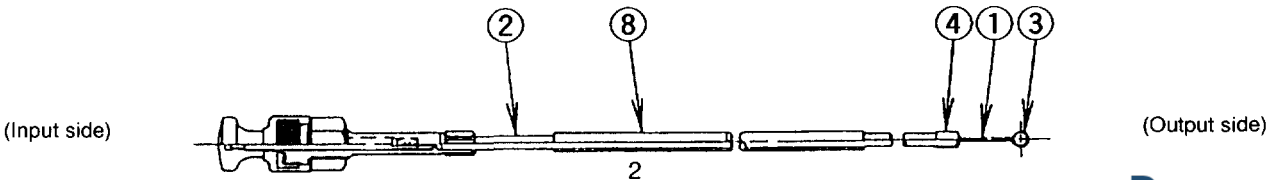
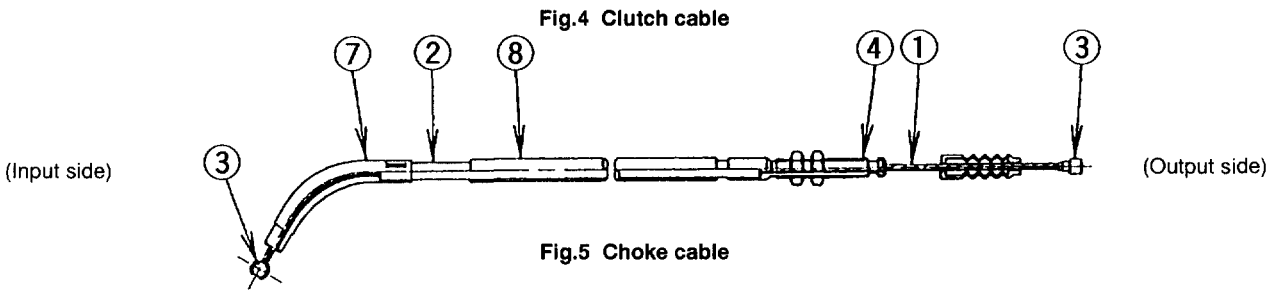
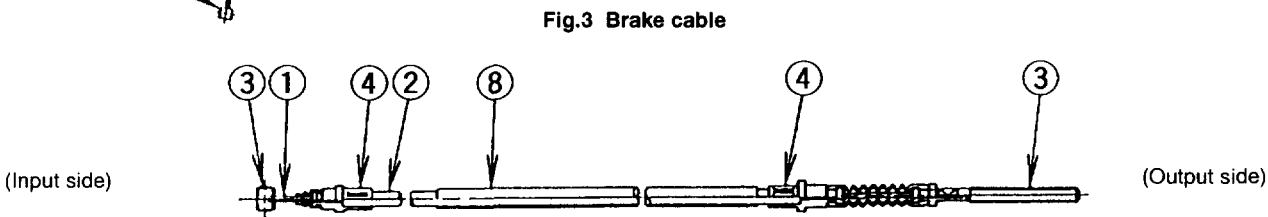
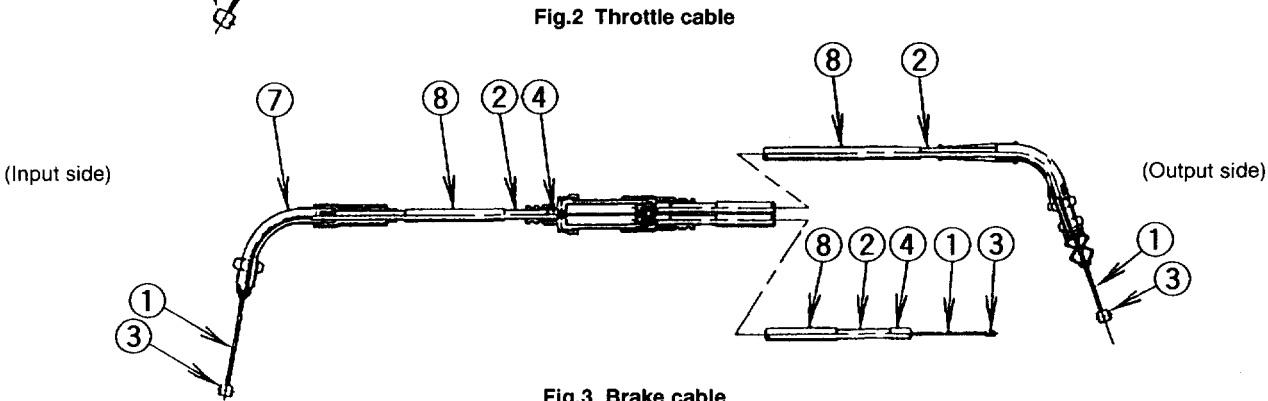
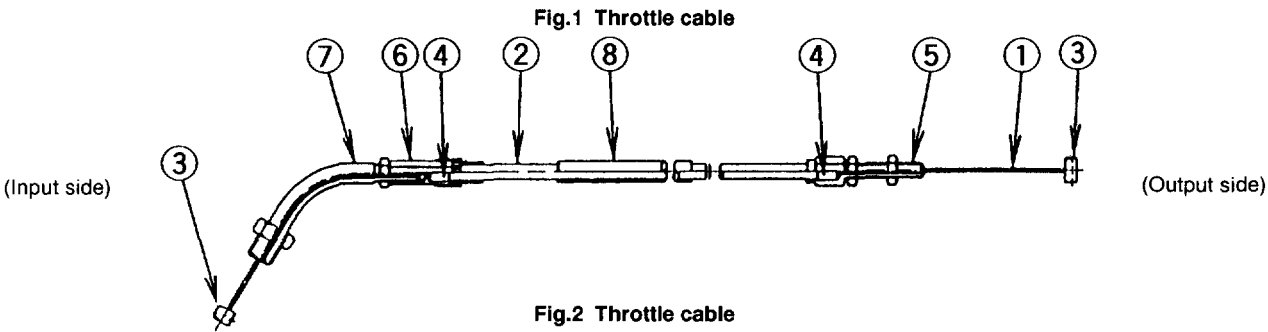
JIS B 0205	Metric coarse screw threads
JIS B 0207	Metric fine screw threads
JIS B 0209	Limits of sizes and tolerances for metric coarse screw threads
JIS B 0211	Limits of sizes and tolerances for metric fine screw threads
JIS B 0403	Castings- systems of dimensional tolerances and cutting stocks
JIS B 0405	Permissible machining deviations in dimensions without tolerance indication
JIS B 0408	Permissible deviations in dimensions without tolerance indication for press working of sheet metal
JIS B 0410	Permissible deviations in dimensions without tolerance indication for shearing of metal plates
JIS B 0415	Dimensional tolerance for steel die forgings (Hammer and press forgings)
JIS B 1180	Hexagon head bolts
JIS B 1181	Hexagon nuts
JIS D 0201	General rules of electroplating for automobile parts
JIS G 3101	Rolled steel for general structure
JIS G 3445	Carbon steel tubes for machine structural purposes
JIS G 3506	High carbon steel wire rods
JIS G 3525	Wire rope
JIS G 3535	Wire ropes for aeronautical use
JIS G 3539	Carbon steel wires for cold heading and cold forging
JIS G 4051	Carbon steels for machine structural use
JIS G 4308	Stainless steel wire rods
JIS G 4804	Free cutting carbon steels
JIS H 3100	Copper and copper Alloy - sheets, plates, strip and coiled sheets
JIS H 3250	Copper and copper alloy - rods and bars
JIS H 5301	Zinc alloy die castings

2. Names of main components

The names of main components of the cable shall be as shown in Table 1.

Table 1 Names of main components

No.	Name of componet	Examples of combinations	No.	Name of componet	Examples of combinations
1	Inner cable	Figs.1 to 5	5	Adjusting bolt	Figs.1 to 5
2	Outer casing		6	Adjusting nut	
3	Cable end		7	Round joint	
4	Casing cap		8	Protector	



3. Types of main components

The types of main components of the cable shall be as shown in **Table 2**.

Table 2 Types of main components

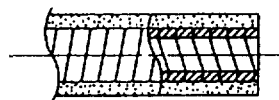
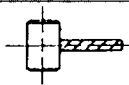
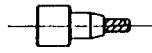
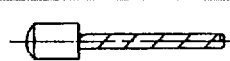
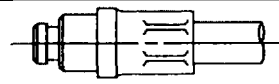
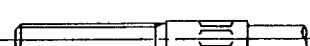
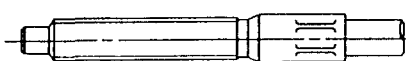
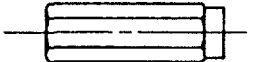
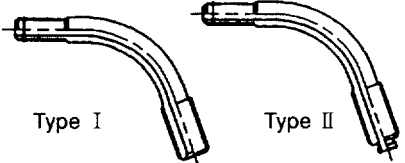
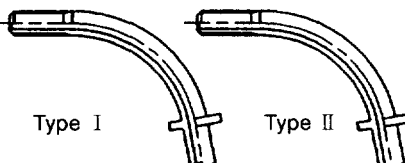
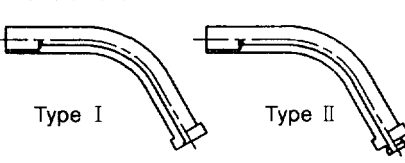
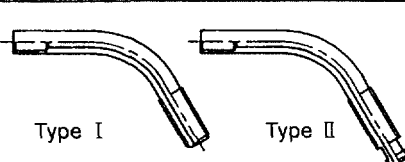
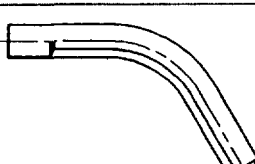
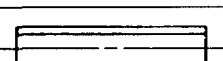
No.	Name of component	Type		Remarks	Diagrammatic sketch of shape	Applicable Attached Tables
1	Inner cable	Strand	Single strand	Has the highest breaking strength among cables of the same outside diameter.		Attached Tables 1 and 2
			Multiple strand	Has the highest flexibility among cables of the same outside diameter.		Attached Tables 1 and 2
		With coating		Has a high operational efficiency under high load.		Attached Tables 3
2	Outer casing	With liner		Has a high operational efficiency.		Attached Tables 4
		Without liner		Used for the inner coat type.		Attached Tables 5
3	Cable end	Type A		Drum-shaped (casting)		Attached Tables 6
		Type B		Umbrella-shaped (casting)		Attached Tables 7
		Type C		Cylindrical (soldering)		Attached Tables 8
		Type D		Threaded type (with flange)		Attached Tables 9
		Type E		Threaded type		Attached Tables 10
4	Casing cap	Type A		Cap-shaped		Attached Tables 11
		Type B1	With flange		Attached Tables 12	
		Type B2			Attached Tables 13	
		Type C		Stepped (with grooves)		Attached Tables 14
		Type D1	Threaded type	Type A 	Attached Tables 15	
		Type D2		Type B 		
Type D2		Threaded type (stepped)		Attached Tables 16		

Table 2 Types of main components (continued.)

No.	Name of component	Type	Remarks	Diagrammatic sketch of shape	Applicable Attached Tables
5	Adjusting bolt	Type A	For staking		Attached Tables 17
6	Adjusting nut	Type A	For staking box nut		Attached Tables 18
7	Round joint	Type A1	For rotary staking (Without flange)		Attached Tables 19
		Type A2	For rotary staking (With flange)		Attached Tables 20
		Type B1	For direct staking		Attached Tables 21
		Type B2	For direct staking (threaded)		Attached Tables 22
		Type B3	For direct staking (non-threaded)		Attached Tables 23
8	Protector				Attached Tables 24

4. Performance requirements

The performance of the components and assemblies of the cable shall be as follows:

- (1) For the assemblies, the breaking load for inner cable, the compression load for outer casing, the pull-off load of cable end, casing cap and round joint shall meet the specified values shown in **Attached Tables 1, 4 to 16 and 21 to 23**.
- (2) Cables, depending on the application, shall meet the requirements for the load efficiency, stroke loss, operating durability and other practical functions established based on an agreement between the parties concerned.
- (3) To meet the performance requirements described in Items (1) and (2), an appropriate lubricant may be applied to the inner cable or filled in the outer casing of the cable.

The types of usable lubricants shall be as specified in an agreement between the parties concerned.

5. Shape and dimensions

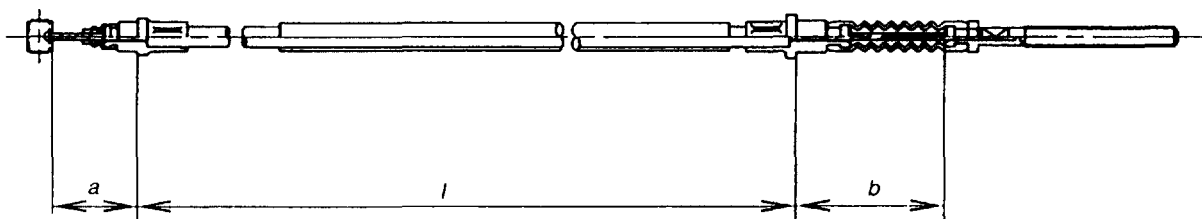
The shapes and dimensions of the components and assemblies of the cable shall be as follows:

- (1) The shapes, dimensions and tolerances of the components shall meet the specified values shown in **Attached Tables 1 to 24**.
- (2) Unless otherwise specified, the dimensional tolerances of the components shall be as listed in **Table 3**.
- (3) The dimensional tolerances of the assemblies shall be as listed in **Table 4**.

Table 3 Dimensional tolerances of components

Machining type	Applicable standards
Permissible deviation in dimension without tolerance indication (Cutting)	JIS B 0405, Medium or coarse class
Permissible deviation in dimension without tolerance indication (Forgings)	JIS B 0415, Standard class
Permissible deviation in dimension without tolerance indication (Press working)	JIS B 0408, B class
Permissible deviation in dimension without tolerance indication (Die casting)	JIS B 0403
Permissible deviation in dimension without tolerance indication (Shearing)	JIS B 0410, B class

Table 4 Dimensional tolerances of assemblies



Unit: mm

l		$a + b$ (Travel length)
Nominal size	Tolerance	Tolerance
Less than 1,500	± 3	± 1.5
1,500 or more	± 4	± 2.0

6 Appearance

- (1) The components shall be free from practically harmful defects, such as scratch, bending, crack, rust, scar and burr.
- (2) The surface treatment of the components shall be as specified in the Remarks of **Attached Tables 1, 4, 5, 9 11 and 13 to 23.**

7. Materials

The materials of the components shall be as specified in the Remarks of **Attached Tables 1 and 3 to 24.**

8. Test method

8.1 Test items

The test shall be performed for the following test items:

- (1) Breaking load test for inner cable
- (2) Elongatin test for inner cable
- (3) Compression load test for outer casing
- (4) Pull-off load test for cable end, casing cap and round joint
- (5) Performance evaluation test for assemblies
- (6) Operational durability test

8.2 Breaking load test for inner cable

Fix both ends of a test piece on the holders of the test apparatus in an appropriate way, pull the test piece to break it at a speed of less than 50 mm/min and measure the breaking load when it breaks. The distance between holders shall be 250 mm or more. For the test piece which does not meet the breaking load values specified in **Attached Table 1** and broke at the portion fixed by the holder, take a new test piece from the same inner cable and test it again.

8.3 Elongatin test for inner cable

Fix both ends of a test piece on the holders of the test apparatus in an appropriate way, apply a load of 2% of the breaking load specified in **Attached Table 1** to the test piece, give gauge markings on it not less than 250 mm apart, and then measure the distance between gauge markings (L_1).

Then, pull the test piece at a speed of less than 50 mm/min, apply a load of 60% of the specified breaking load, and measure the distance between gauge markings (L_2). Return the applied load to 2% of the breaking load, and measure the distance between gauge markings (L_3).

The total elongation percentage, permanent elongation percentage and elastic enlongation percentage shall be expressed in the following formulas:

$$C_1 = \frac{(L_2 - L_1)}{L_1} \times 100$$

$$C_0 = \frac{(L_3 - L_1)}{L_1} \times 100$$

$$C_2 = C_1 - C_0$$

where, C_0 : Permanent elongation percentage of inner cable (%)

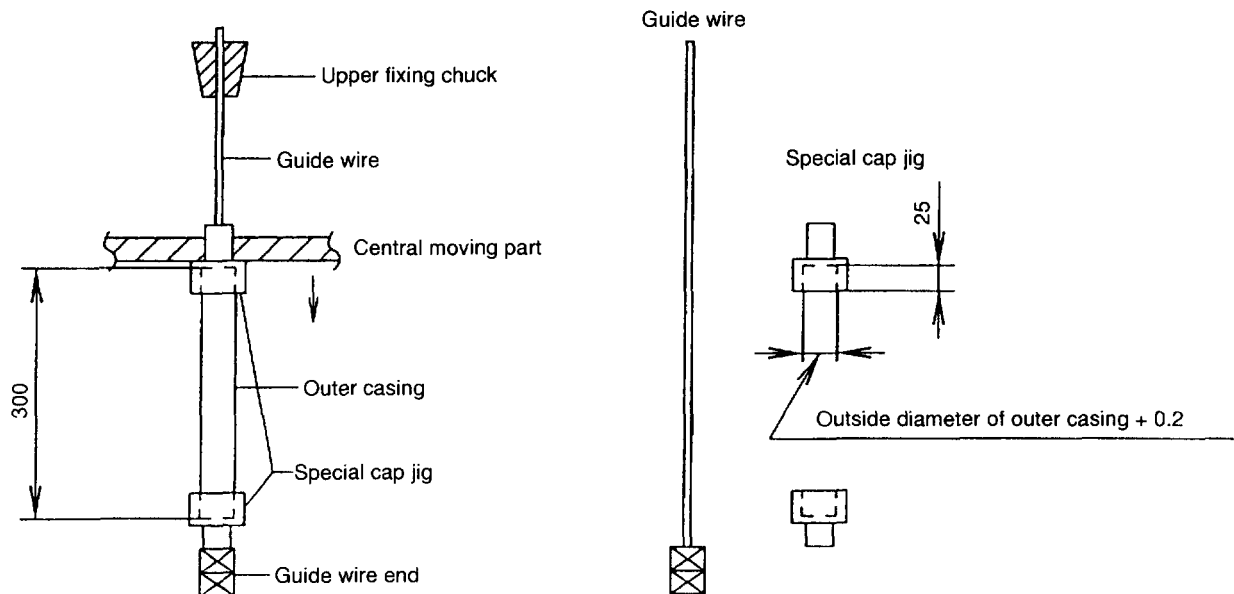
C_1 : Total elongation percentage of inner cable (%)

C_2 : Elastic elongation percentage of inner cable (%)

8.4 Compression load test for outer casing

Set a 300 mm long test piece of outer casing on the test apparatus as shown in **Fig.6**, apply the compression load to the test piece at a speed of less than 20 mm/min until it is crushed, and then measure the compression load.

Fig.6



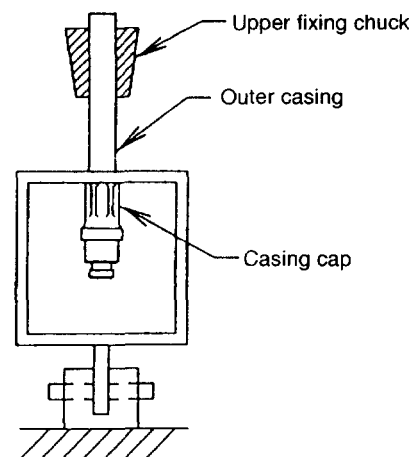
<Sizes of guide wire>

	Unit: mm				
Outside diameter of outer casing	φ5	φ6	φ7	φ8	φ9
Diameter of guide wire	φ1.8	φ2.1	φ2.6	φ3.5	φ4.0

8.5 Pull-off load test for cable end, casing cap and round joint

Fix both ends of a test piece on the holders of the test apparatus in such a manner as to allow the pull-off load to be measured and in an appropriate way, respectively. Pull the test piece at a speed of less than 50 mm/min until the cable end, casing cap and round joint are separated, and then measure the pull-off load. For the test piece which does not meet the pull-off load values specified in **Attached Tables 6 to 16 and 21 to 23** and broke at any portions other than the cable end, casing cap or round joint, take a new test piece from the same cable and test it again.

Fig.7

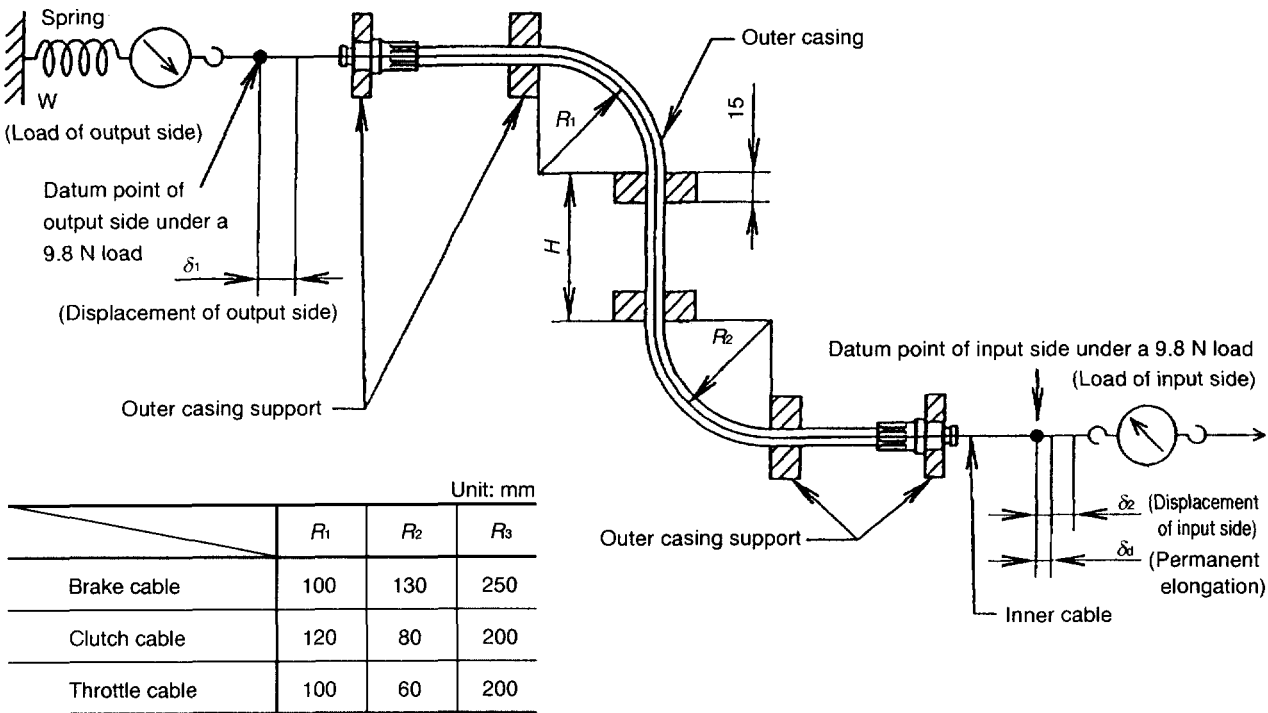


8.6 Performance evaluation test for assemblies

In the performance evaluation test for assemblies, the load efficiency (η) and stroke loss (S) shall be mainly evaluated. Install the outer casing as shown in Fig.8 and fix one end of the inner cable with a spring of spring constant (K). Gradually pull the other end of the inner cable, and then measure the load of output side (W), the displacement of output side (δ_1), the load of input side (F) and the displacement of input side (δ_2).

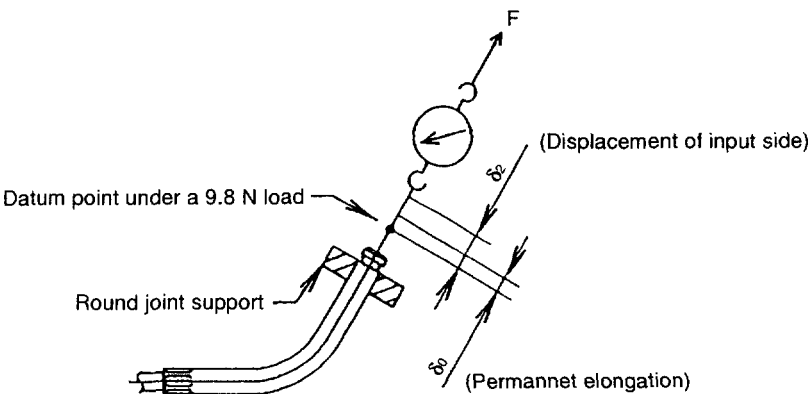
After removing the load of input side F , measure the apparant permanent elongation (δ_0). In this case, the datum points for measuring the displacement of output side (δ_1), the displacement of input side (δ_2) and the apparant permanent elongation (δ_0) shall be determined from the position of the cable when a 9.8 N load has been applied before the application of the load of input side (F) for measurement. For the evaluation of the load efficiency, the load of output side (W) may be a constant load. The values of W and F shall be specified in an agreement between the parties concerned.

Fig.8



Remark 1. When a round joint is used, the test method shall be as shown in Fig.9.

Fig.9



Remark 2. The performance evaluation test of a cable having multiple branched cables at the output side shall be also conducted according to this test method. In this case, care shall be given to the following items for the installation of a test piece on the test apparatus.

- 1) Each branched cable shall be installed in accordance with **Fig.8**. The load shall be so applied that the force equally divided by the number of branched cables will be applied to each cable.
- 2) The joint of branched cables shall be so installed that it will be positioned in the straight portion of the cable, not in the curved portion shown in **Fig.8**.

(1) Load efficiency

The load efficiency (η_w) shall be expressed in the following formula:

$$\eta_w = \frac{W}{F} \times 100$$

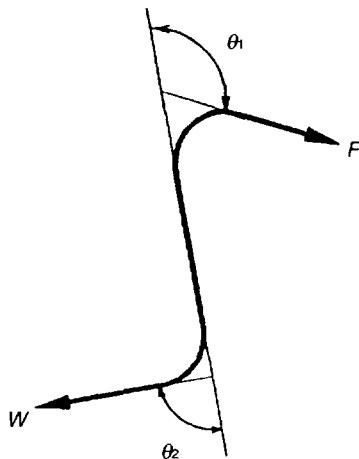
where, η_w : Load efficiency (%)

W: Load of output side (N)

F : Load of input side (N)

Remark: The formula, $\eta_w = e^{-\mu\theta}$, is generally used to express the load efficiency as a theoretical value. (Refer to **Fig.10**.)

Fig.10



θ : Total bending angle (rad)

$$\theta = \sum_{i=1}^n \theta_i$$

μ : Coefficient of friction

$$\mu = 0.06$$

(For polyethylene liner)

e: Exponential

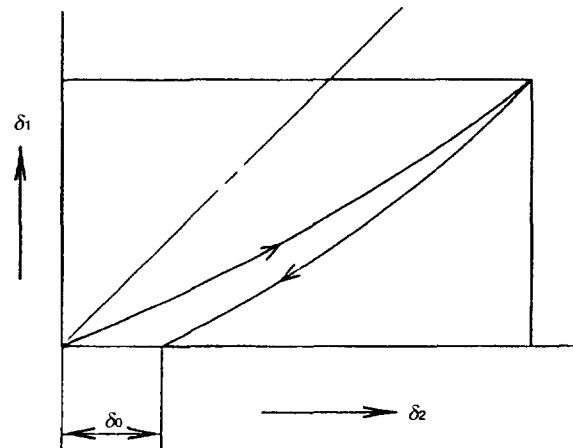
$$e = 2.718$$

(2) Stroke loss

The stroke loss (S) shall be expressed in the following formula: (Refer to **Figs.8** and **11**.)

$$S = \delta_2 - \delta_1$$

Fig.11



8.7 Operational durability test

8.7.1 Test procedure

The test procedure shall be as follows:

- (1) Performance measurement before durability test
- (2) Operational durability test
- (3) Performance measurement after durability test
- (4) Analysis of durables

Performance measurement may be often conducted during the durability test.

8.7.2 Setting of cable

The cable shall be set in the same way as specified in Fig.8.

8.7.3 Performance measurement before durability test

This test shall be conducted according to Section 8.6 **Performance evaluation test for assemblies**.

Pull the input side of the inner cable at the operating speed shown in Table 5, apply the specified load to the output side, and then measure the load efficiency and stroke loss.

The measurement of any items other than the load efficiency and stroke loss shall be in accordance with an agreement between the parties concerned.

8.7.4 Operational durability test

Give the load and stroke repeatedly to the input side of cable so that the maximum load and stroke shown in Table 6 can be kept at the output side.

The repetition times per minute and endurance times are also shown in Table 6.

8.7.5 Performance measurement after durability test

This test shall be conducted by the same method as specified in Section 8.7.3 **Performance measurement before durability test**.

8.7.6 Analysis of durables

Check test pieces which have been tested for durability and those which have broken during the durability test for appearance defects and damages.

Table 5 Specifications for performance measurement

Cable name		Specified load W (N)	Operating speed (mm/s)
Front brake		540	10
Rear brake	Lever type	540	10
	Foot type	780	10
Clutch		290	10
Throttle		100	10

Table 6 Specifications for operational durability test

Cable name		Initial tensile force (N)	Specified load of output side (N)	Stroke of output side (mm)	Repetition cycle (times/min.)	Endurance times (million times)
Front brake		50	540	15	30	15
Rear brake	Lever type	50	540	15	30	15
	Foot type	50	780	10	30	20
Clutch		50	290	20	60	30
Throttle		20	100	25	60	50