European Aviation Safety Agency

European Technical Standard Order (ETSO)

Subject: **TOW RELEASE**

1 - Applicability

This ETSO specifies the requirements which Tow Releases that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A**.**

2.2 - Specific

None.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard

Standard given in the Minimum Performance Standard for Tow Release is given in the **Appendix 1**.

3.1.2 - Environmental Standard

The equipment must be tested according to the applicable environmental standards contained in EUROCAE ED-14E (RTCA/DO-160E) "*Environmental Conditions and Test Procedures for Airborne Equipment"* from March 2005.

3.1.3 - Computer Software

See CS-ETSO Subpart A paragraph 2.2

3.2 - Specific

None.

4 - Marking

4.1 - General

Marking is detailed in CS-ETSO Subpart A paragraph 1.2.

4.2 - Specific

None.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

A copy of the reference LN (Luftfahrt-Norm) may be obtained from the web-site: www.normung.din.de

APPENDIX 1.

TOW RELEASE

1. GENERAL

1.1 Type and applicability of airworthiness requirements

These airworthiness requirements for tow releases (ETSO-2C513) are valid for proof of airworthiness of tow releases that are used for:

a) towing steerable or non-steerable tow or built into such tow;

b) or for towing by winch or motor vehicle.

Note: Gliders and powered gliders are examples of steerable tows.
Banners are examples of non-steerable tows.

All the individual specifications listed below for ensuring the airworthiness of tow releases are minimum requirements that have been derived from operating experience and have been quantified as practical numerical values.

Deviations from these requirements may be approved or requested by the Agency, if justified by new findings or safety considerations.

1.2 Type approval

1.2.1. A tow release type can be approved on application in the form of an ETSO entitlement, provided that the airworthiness requirements are fully met, or, in the event of non-compliance of one or more requirements, if proof is provided that an equivalent safety level is achieved.

The decision of the Agency is final.

1.2.2. The burden of proof is borne by the applicant, who also has to compile the type documentation.

1.2.3. The type documentation includes all the documentation necessary for the design specification of the tow release and all its design features that are subject matters of this ETSO.

2. DESIGN AND CONSTRUCTION

2.1 Materials

The suitability and reliability of the materials used must be shown based on operating experience or materials testing.

All materials used for stressed parts must correspond to descriptions and specifications recognized by the Agency.

2.2 Protection of parts

Each part of the load transmitting assembly must

a) be protected as fully as possible against influences that could cause damage or diminish strength during operation, including corrosion and wear;

b) and designed in such a way that:
- no water can be collected and that;
- any dirt inside the tow release can be removed without disassembly.

2.3 Securing connecting elements

Accepted security devices must be used for all non permanent connecting elements of the tow release.

2.4 Connecting ring pair

For each tow release with a hook, a connecting ring pair according to LN (Luftfahrt-Norm) 65091 in the current valid version must be used.

2.5 Attachment to the aircraft

The tow release must be designed to be attached to the aircraft using non permanent connecting elements.

2.6 Special requirements

2.6.1 Tow releases with a moveable or fixed ring jaw must be designed in such a way that it is impossible to hook up the large oval ring of the connecting ring pair. It must be also impossible for the connecting ring pair to jam behind or either side of the hook.

2.6.2 It must not be possible, in any operating state, for the connecting ring pair to jam in the tow release jaw and thus inhibit the release.

2.6.3 Tow releases installed near the centre of gravity of the aircraft must have a mean for automatic release.

2.7 Long-term performance

The documentation must include proof of at least 10,000 actuations of the tow release under operating conditions. No damage should occur during this time.

3. STRENGTH

3.1 Strength calculations

Load tests according to § 4.2.5 and § 4.2.6 must show that the strength of the tow release is adequate to withstand any loads that may be put on it in any operating state that experience has shown may occur.

3.2 Criteria for sufficient dimensioning and safety factor

3.2.1 The strength requirements are specified by the safe test load (the maximum expected cable load during operation) and the calculated breaking load (the maximum cable load multiplied by the specified safety factor) defined in § 3.3.

These loads are specified as limiting values in the test schedules for the functional tests.

3.2.2 A safety factor of 1.5 is specified.

The unit must be able to:

a) accept the safe test load without permanent damage in the form of deformation, notches, cracks, etc.;

b) withstand the calculated breaking load without failure for at least 3 seconds.

3.3 Safe test load

Tow releases used for the purposes as listed in § 1.1 must be designed for a safe test load L_{max} N that is derived as follows from CS 22.581 and CS 22.583:

L_{max} = 1.2 x 1.3 x m x 9.81 [N]

where	1.2 and 1.3:	safety factors
	m:	max. take-off weight
	9.81 m/s²:	gravitational acceleration/conversion to Newton

Note: For a maximum towed mass of, for instance, 850 kg the safe test load is thus:
L_{max} = 1.2 x 1.3 x 850 x 9.81 = 13,008 N = L_{max}

In-line weak links are ignored when determining the safe test load.

4. OPERATING BEHAVIOUR

4.1 Performance under load

4.1.1 Safe operating range

Within the limits of cable loads and cable angles specified in § 5.1, every tow release must be able both to withstand the resultant load without impairing operational reliability and to release reliably.

4.1.2 Automatic release angle

For tow releases for installation in gliders or powered gliders for towing by winch or motor vehicle the tow cable must release reliably at the automatic release angle specified in § 5.1.

4.1.3 Release force

When loading the hook of the tow release within the limits specified for cable loads and cable angles, the maximum permissible release F_K measured at the release lever with a reference length l of 68 mm (see Fig. 1) must lie between 60 and 140 N.

4.2 Functional tests

4.2.1 Type of tests

The aim of the functional tests using a suitable test rig is to prove that the tow release for which type approval is to be granted meets the requirements as listed above in § 4.1.1 to § 4.1.3.

The available restoring force after releasing the tow cable must be measured according to § 4.2.4.

Note: Type testing of a tow release should include its use in actual flight operations in order to gain more information on its operating performance.

4.2.2 Load schedule

Test loads must be applied according to the load schedule in Fig. 1

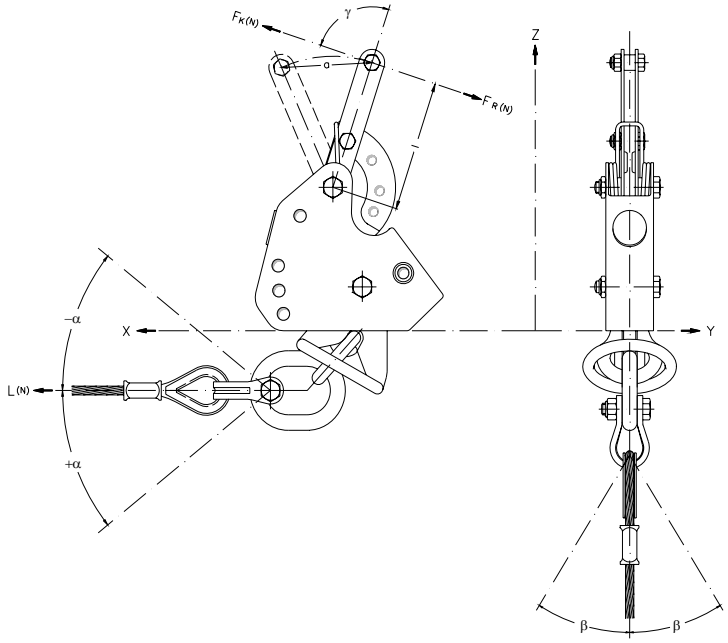

Fig. 1: Load schedule

x-axis = Longitudinal axis (in flight direction)
y-axis = Lateral axis (in wing span direction)
z-axis = Vertical axis
L = Cable load in N

l = Original lever length of type in mm
F_K = Release force of release lever in N
F_R = Restoring force in N
α = Angle between L and x-y plane
a = Travel of release lever
β = Angle between L and x-z plane between stops in mm
The normal or 0-degrees cable angle is parallel to the x-y plane

4.2.3 Test rig

Using only the bore holes and bearing surface provided for installation in the aircraft, mount the tow release in a suitable test rig in such a way that the cable loads can be applied via the connecting ring pair for all specified load angles and that in each case the required release force F_K can be measured at the release lever.

In addition, for tow releases with automatic release (so-called safety tow releases), the cable angle and the magnitude of the cable load that results in automatic release must be measured.

4.2.4 Measurement of the restoring force

Measure the restoring force as follows prior to the start of the actual functional tests:

a) Fully open the unloaded tow release mounted in the test rig using the release lever (lever length l = 68 mm).

b) Measure the restoring force between the release lever stops, in relation to the release travel a.

Enter the measurement results in a diagram.

The restoring force F_R must not be greater than 100 N nor less than 60 N.

4.2.5 Test schedules and determination of the load diagram:

Tow releases for aero tow of steerable and non-steerable tows (use according to § 1.1.a)

a) Test up to safe test load
With the tow release mounted in the test rig, load the hook via the connecting ring pair according to the cable (test) load schedule in Table 1.
- Apply the load at a rate of 300 N/s.
- Apply the load for 5 seconds at each load stage and measure the release force F_K using a reference release lever length of l = 68 mm.

- Disassembly test

Disassemble the tow release completely on completion of the load test.
Inspect the tow release to ensure that
- no part of it is permanently deformed and that no notches, cracks, etc., have appeared and that
- on reassembly the tow release is once again fully functional.

Table 1

Cable (test) load L		**Cable angle**		**Cable (test) load L**		**Cable angle**	
		α	**± β**			**α**	**± β**
N		**Degrees**	**Degrees**	**N**		**Degrees**	**Degrees**
1500		-45	0	1500		+30	0
6000		-45	0	6000		+30	0
7500		-45	0	7500		+30	0
9000		-45	0	9000		+30	0
11700		-45	0				
				0,80	Lmax	+30	0
	Lmax	-45	0	0,60	Lmax	+30	30
0,60	Lmax	-45	30	0,80	Lmax	+30	30
0,80	Lmax	-45	30	0,60	Lmax	+30	45
0,60	Lmax	-45	45	0,80	Lmax	+30	45
0,80	Lmax	-45	45	1500		+45	0
				6000		+45	0
1500		-30	0	7500		+45	0
6000		-30	0	9000		+45	0
7500		-30	0	11700		+45	0
9000		-30	0				
					Lmax	+45	0
0,80	Lmax	-30	0	0,60	Lmax	+45	30
0,60	Lmax	-30	30	0,80	Lmax	+45	30
0,80	Lmax	-30	30	0,60	Lmax	+45	45
0,60	Lmax	-30	45	0,80	Lmax	+45	45
0,80	Lmax	-30	45	0,80	Lmax	+30	60
				0,80	Lmax	+30	75
1500		0	0	0,80	Lmax	+45	60
6000		0	0	0,80	Lmax	+45	75
7500		0	0	0,80	Lmax	+60	0
9000		0	0	0,80	Lmax	+60	30
11700		0	0	0,80	Lmax	+60	45
	Lmax	0	0	0,80	Lmax	+60	60
				0,80	Lmax	+60	75
1500		0	30				
6000		0	30	9000		+60	87
7500		0	30	11700		+60	87
9000		0	30		Lmax	+60	87
11700		0	30	0,40	Lmax	+120	0
	Lmax	0	30	0,40	Lmax	-120	0
1500		0	45				
6000		0	45				
7500		0	45				
9000		0	45				
11700		0	45				
	Lmax	0	45				
0,60	Lmax	0	90				
0,80	Lmax	0	90				

b) Test to calculated breaking load

Subsequent to the disassembly test and with the tow release remounted in the test rig, load the hook via the connecting ring pair up to the calculated breaking load with cable angles
α = 0 degrees and β = 0 degrees.

Maintain the calculated breaking load for 3 seconds. Then release and measure the release force F_K. Then disassemble the tow release completely and inspect it for any permanent deformation, notches, cracks, etc.

4.2.6 Test schedules and determination of the load diagram:

Tow release for installation in gliders or powered gliders for towing by winch or motor vehicle (use according to § 1.1.b)

a) Test up to safe test load

With the tow release mounted in the test rig, load the hook via the connecting ring pair according to the cable (test) load schedule in Table 2.

- Apply the load at a rate of 300 N/s.
- Apply the load for 5 seconds at each load stage and measure the release force F_K using a reference release lever length of l = 68 mm.

Automatic release of the tow release is not allowed during this test schedule.

Table 2

Cable (test) load L		Cable angle α	± β	Cable (test) load L		Cable angle α	± β
N		Degrees	Degrees	N		Degrees	Degrees
1500		0	0	1500		+45	0
6000		0	0	6000		+45	0
7500		0	0	7500		+45	0
9000		0	0	9000		+45	0
11700		0	0				
	Lmax	0	0	0,80	Lmax	+45	0
1500		0	30	1500		+45	30
6000		0	30	6000		+45	30
7500		0	30	7500		+45	30
9000		0	30	9000		+45	30
11700		0	30	11700		+45	30
					Lmax	+45	30
	Lmax	0	30				
				1500		+45	45
1500		0	45	6000		+45	45
6000		0	45	7500		+45	45
7500		0	45	9000		+45	45
9000		0	45	0,80	Lmax	+45	45
11700		0	45				
				1500		+45	60
	Lmax	0	45	6000		+45	60
				7500		+45	60
1500		+30	0	9000		+45	60
6000		+30	0	11700		+45	60
7500		+30	0		Lmax	+45	60
9000		+30	0				
0,80	Lmax	+30	0	1500		+45	75
				6000		+45	75
1500		+30	30	7500		+45	75
6000		+30	30	9000		+45	75
7500		+30	30	11700		+45	75
9000		+30	30		Lmax	+45	75
11700		+30	30	0,60	Lmax	+60	0
	Lmax	+30	30	0,80	Lmax	+60	0
				0,60	Lmax	+60	30
0,60	Lmax	+30	45	0,80	Lmax	+60	30
0,80	Lmax	+30	45				
0,60	Lmax	+30	60	1500		+60	45
0,80	Lmax	+30	60	6000		+60	45
				7500		+60	45
1500		+30	75	9000		+60	45
6000		+30	75	11700		+60	45
7500		+30	75		Lmax	+60	45
9000		+30	75				
11700		+30	75				
	Lmax	+30	75				

Table 2 (cont.)

Cable (test) load		Cable angle	
L		α	± β
N		Degrees	Degrees
0,60	Lmax	+60	60
0,80	Lmax	+60	60
1500		+60	75
6000		+60	75
7500		+60	75
9000		+60	75
11700		+60	75
	Lmax	+60	75
11700		+60	87
	Lmax	+60	87
1500		+75	0
6000		+75	0
7500		+75	0
9000		+75	0
11700		+75	0
	Lmax	+75	0
0,60	Lmax	+75	30
0,80	Lmax	+75	30
0,60	Lmax	+75	45
0,80	Lmax	+75	45
0,60	Lmax	+75	60
0,80	Lmax	+75	60
0,80	Lmax	0	75
1500		0	87
6000		0	87
7500		0	87
9000		0	87
11700		0	87
	Lmax	0	87

- Disassembly test
  Disassemble the tow release completely on completion of the load test. Inspection the tow release to ensure that
  - no part of it is permanently deformed and that no notches, cracks, etc., have appeared and that
  - on reassembly the tow release is once again fully functional.

b) Determining the angle for automatic release
- With the tow release mounted in the test rig, load the hook via the connecting ring pair according to the cable (test) load schedule in Table 3.
- At each load stage measure the angle α_s, at which release occurs automatically.

Table 3

Cable (test) load L N	Cable angle β Degrees		Cable (test) load L N	Cable angle β Degrees
20	0		100	75
20	45		150	0
20	75		150	45
30	0		150	75
30	45		500	0
30	75		500	30
40	0		500	45
40	45		500	60
40	75		500	75
50	0		1000	0
50	45		1000	0
50	75		2000	0
100	0		2000	60
100	45		3000	0
			3000	80

c) Test to calculated breaking load
On completion of the load test according to a) with subsequent disassembly test and the determination of the angle at which automatic release occurs according to b), remount the tow release in the test rig and load the hook via the connecting ring pair up to the calculated breaking load with cable angles α = 0 degrees and β = 0 degrees.
Maintain the calculated breaking load for 3 seconds. Then release and measure the release force F_K. Then disassemble the tow release completely and inspect it for any permanent deformation, notches, cracks, etc.

5. OPERATING LIMITS, MARKINGS AND DOCUMENTATION

5.1 Operating limits

5.1.1 The operating limits listed in § 4.2.5 and § 4.2.6 must be specified for every tow release and be provided to the holder of the aircraft in which a tow release of the type in question is being installed (see also Table 4).

Table 4

Tow release according to §	1.1.a)	1.1.b)
Cable angle at which the tow cable can be reliably released		
α (upwards)	-90°	-,-
α (downwards)	+90°	+75°
β (to either side)	0-87°	0-87°
Maximum permissible cable load at which the tow cable can be reliably released		
L_{max}	Cable load	Cable load
Automatic release angle		
α_s	-,-	75°-90°

5.2 Operating and maintenance documentation

5.2.1 On delivery, each tow release must be accompanied by operating and maintenance documentation. This documentation must contain all the information necessary to maintain the tow release in a fully operational condition.

5.2.2 A copy of the service and maintenance documentation must be shown to the Agency.

5.2.3 All the information in § 5.1 and any further information necessary for safe and reliable operation of the tow release must be included in the operating documentation.

5.2.4 As a minimum, the maintenance documentation must cover the following:

a) Installation of the tow release in the aircraft

b) Set-up data necessary for the safe and reliable functioning of the tow release

c) Checks and tests to be carried out after installation

d) Cleaning and care of the tow release

e) Detailed description and frequency of maintenance work (inspection schedules)