

## European Technical Approval ETA-13/0506

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung <i>Trade name</i>	Mungo Betonschraube MCS-A <i>Mungo Concrete Screw Anchor MCS-A</i>
Zulassungsinhaber <i>Holder of approval</i>	Mungo Befestigungstechnik AG Bornfeldstrasse 2 4603 OLTEN SCHWEIZ
Zulassungsgegenstand und Verwendungszweck <i>Generic type and use of construction product</i>	Betonschraube in den Größen 8, 10, 12 und 16 zur Verankerung im Beton mit metrischem Schraubenkopf und Senkschraubenkopf <i>Concrete screw with metric threaded head and countersunk head of sizes 8, 10, 12 and 16 for use in concrete</i>
Geltungsdauer: <i>Validity:</i>	vom <i>from</i> bis <i>to</i> 7 June 2013 7 October 2016
Herstellwerk <i>Manufacturing plant</i>	Plant 3

Diese Zulassung umfasst  
*This Approval contains*

16 Seiten einschließlich 9 Anhänge  
*16 pages including 9 annexes*

## I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:
  - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products<sup>1</sup>, modified by Council Directive 93/68/EEC<sup>2</sup> and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council<sup>3</sup>;
  - *Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998<sup>4</sup>, as amended by Article 2 of the law of 8 November 2011<sup>5</sup>;*
  - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC<sup>6</sup>;
  - Guideline for European technical approval of "Metal anchors for use in concrete - Part 3: Undercut anchors", ETAG 001-03.
- 2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.
- 3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.
- 4 This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.
- 5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.
- 6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

<sup>1</sup> Official Journal of the European Communities L 40, 11 February 1989, p. 12  
<sup>2</sup> Official Journal of the European Communities L 220, 30 August 1993, p. 1  
<sup>3</sup> Official Journal of the European Union L 284, 31 October 2003, p. 25  
<sup>4</sup> *Bundesgesetzblatt Teil I 1998*, p. 812  
<sup>5</sup> *Bundesgesetzblatt Teil I 2011*, p. 2178  
<sup>6</sup> Official Journal of the European Communities L 17, 20 January 1994, p. 34

## II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

### 1 Definition of product and intended use

#### 1.1 Definition of the construction product

The Mungo Concrete Screw Anchor MCS-A of sizes 8, 10, 12 and 16 is made of zinc plated steel. The anchor is screwed into a predrilled cylindrical drill hole. The special thread of the anchor cuts an internal thread into the member while setting. The anchorage is characterised by mechanical interlock in the special thread.

An illustration of the product and intended use is given in Annex 1.

#### 1.2 Intended use

The anchor is intended to be used for anchorages for which requirements for mechanical resistance and stability and safety in use in the sense of the Essential Requirements 1 and 4 of Council Directive 89/106 EEC shall be fulfilled and failure of anchorages made with these products would cause risk to human life and/or lead to considerable economic consequences.

The anchor is to be used only for anchorages subject to static or quasi-static loading in reinforced or unreinforced normal weight concrete of strength classes C20/25 at minimum and C50/60 at most according to EN 206:2000-12. It may be anchored in cracked and non-cracked concrete.

The anchor may be used for anchorages with requirements related to resistance to fire.

The anchor may only be used in structures subject to dry internal conditions.

The provisions made in this European technical approval are based on an assumed working life of the anchor of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

### 2 Characteristics of the product and methods of verification

#### 2.1 Characteristics of the product

The anchor corresponds to the drawings and information given in the Annexes. The characteristic material values, dimensions and tolerances of the anchor not indicated in the Annexes shall correspond to the respective values laid down in the technical documentation<sup>7</sup> of this European technical approval.

Regarding the requirements concerning safety in case of fire it is assumed that the anchor meets the requirements of class A1 in relation to reaction to fire in accordance with the stipulations of the Commission decision 96/603/EC, amended by 200/605/EC.

The characteristic values for the design of the anchorages are given in the Annexes.

<sup>7</sup> The technical documentation of this European technical approval is deposited at the Deutsches Institut für Bautechnik and, as far as relevant for the tasks of the approved bodies involved in the attestation of conformity procedure, is handed over to the approved bodies.

Each anchor shall be marked with the identifying mark of the producer, the anchor type, the diameter and the maximum thickness of fixture according to Annex 2.

The anchor shall only be packaged and supplied as a complete unit.

## 2.2 Methods of verification

The assessment of the fitness of the anchor for the intended use with regard to the requirements of mechanical resistance and stability as well as safety in use in the sense of the Essential Requirements 1 and 4 was performed based on ETAG 001 "Guideline for European technical approval of Metal Anchors for Use in Concrete" and Part 3 "Undercut anchors", on the basis of Option 1.

The assessment of the anchor for the intended use in relation to the requirements for resistance to fire has been made in accordance with the Technical Report TR 020 "Evaluation of anchorages in concrete concerning resistance to fire".

In addition to the specific clauses relating to dangerous substances contained in this European technical approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Directive, these requirements need also to be complied with, when and where they apply.

## 3 Evaluation and attestation of conformity and CE marking

### 3.1 System of attestation of conformity

According to the decision 96/582/EG of the European Commission<sup>8</sup> the system 2(i) (referred to as system 1) of attestation of conformity applies.

This system of attestation of conformity is defined as follows:

System 1: Certification of the conformity of the product by an approved certification body on the basis of:

- (a) Tasks for the manufacturer:
  - (1) factory production control;
  - (2) further testing of samples taken at the factory by the manufacturer in accordance with a prescribed control plan;
- (b) Tasks for the approved body:
  - (3) initial type-testing of the product;
  - (4) initial inspection of factory and of factory production control;
  - (5) continuous surveillance, assessment and approval of factory production control.

Note: Approved bodies are also referred to as "notified bodies".

### 3.2 Responsibilities

#### 3.2.1 Tasks of the manufacturer

##### 3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use initial/ raw/ constituent materials stated in the technical documentation of this European technical approval.

<sup>8</sup> Official Journal of the European Communities L 254 of 08.10.1996.

The factory production control shall be in accordance with the control plan which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited at Deutsches Institut für Bautechnik<sup>9</sup>.

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

#### 3.2.1.2 Other tasks of manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of anchors in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval.

#### 3.2.2 Tasks of approved bodies

The approved body shall perform the

- initial type-testing of the product ,
- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control,

in accordance with the provisions laid down in the control plan.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the product stating the conformity with the provisions of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

#### 3.3 CE marking

The CE marking shall be affixed on each packaging of the anchor. The letters "CE" shall be followed by the identification number of the approved certification body, where relevant, and be accompanied by the following additional information:

- the name and address of the holder of the approval (legal entity responsible for the manufacturer),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate of conformity for the product,
- the number of the European technical approval,
- the number of the guideline for European technical approval,
- use category (ETAG 001-1 Option 1),
- size.

<sup>9</sup>

The control plan is a confidential part of the documentation of the European technical approval, but not published together with the ETA and only handed over to the approved body involved in the procedure of attestation of conformity. See section 3.2.2.

#### **4 Assumptions under which the fitness of the product for the intended use was favourably assessed**

##### **4.1 Manufacturing**

The European technical approval is issued for the product on the basis of agreed data/information, deposited with the Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to the Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the approval shall be necessary.

##### **4.2 Design of anchorages**

The fitness of the anchor for the intended use is given under the following conditions:

The anchorages are designed in accordance with the "Guideline for European technical approval of Metal Anchors for Use in Concrete", Annex C, Method A under the responsibility of an engineer experienced in anchorages and concrete work.

Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored.

The position of the anchor is indicated on the design drawings (e.g. position of the anchor relative to reinforcement or to supports, in cracked or non-cracked concrete, etc.).

The design of anchorages under fire exposure has to consider the conditions given in the Technical Report TR 020 "Evaluation of anchorages in concrete concerning resistance to fire". The relevant characteristic anchor values are given in Annexes 8 and 9. The design method covers anchors with a fire attack from one side only. If the fire attack is from more than one side, the design method may be taken only, if the edge distance of the anchor is  $c \geq 300$  mm.

##### **4.3 Installation of anchors**

The fitness for use of the anchor can only be assumed if the following conditions of installation are met:

- Anchor installation carried out by appropriately qualified personnel under the supervision of the person responsible for technical matters on site,
- Use of the anchor only as supplied by the manufacturer,
- Anchor installation in accordance with the manufacturer's specifications and drawings,
- Checks before placing the anchor, to ensure that the characteristic values of the base material in which the anchor is to be placed, is identical with the values, which the characteristic loads apply,
- Check of the concrete being well compacted, e.g. without significant voids,
- Edge distances and spacing not less than the specified values without minus tolerances,
- Placing drill holes without damaging the reinforcement,
- In case of aborted hole: new drilling at a minimum distance away of twice the depth of the aborted hole or smaller distance if the aborted hole is filled with high strength mortar and if under shear or oblique tension load it is not the direction of the load application,

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- Cleaning of the hole of drilling dust,
- Anchor installation such that the embedment depth of the anchor in the concrete is not smaller than the value  $h_{nom}$  given in Annexes 3 and 4,
- Further turning of the anchor is not possible,
- The head of the anchor is fully supported on the fixture and is not damaged.

## 5 Indications to the manufacturer

The manufacturer is responsible to ensure that the information on the specific conditions according to 1 and 2 including Annexes referred to as well as sections 4.2 and 4.3 is given to those who are concerned. This information may be made by reproduction of the respective parts of the European technical approval. In addition, all installation data shall be shown clearly on the packaging and/or on an enclosed instruction sheet, preferably using illustrations.

The minimum data required are:

- Drill bit diameter,
- Size of the anchor,
- Maximum thickness of the fixture,
- Minimum embedment depth,
- Minimum hole depth,
- Information on the installation procedure, including cleaning of the hole, preferably by means of an illustration,
- Reference to any special installation equipment needed,
- Identification of the manufacturing batch.

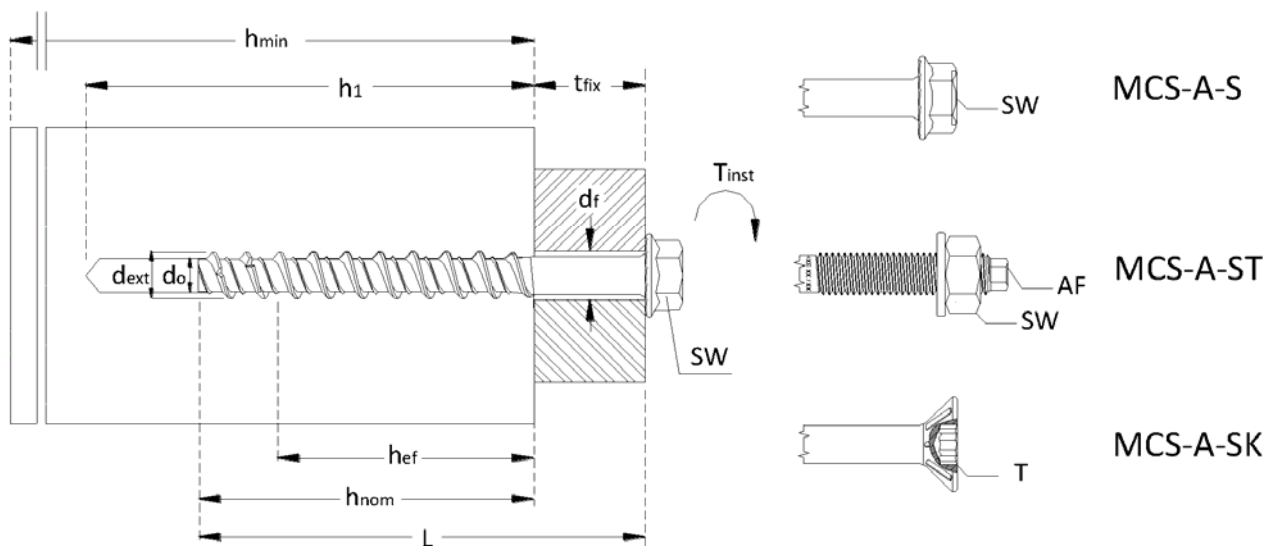
All data shall be presented in a clear and explicit form.

Andreas Kummerow  
p.p. Head of Department

*beglaubigt:*  
Baderschneider

## Mungo Screw anchor MCS-A

The MCS-A-S, MCS-A-ST, and MCS-A-SK concrete screw anchors are made of galvanized steel and are intended to be used in cracked and non-cracked concrete of the strength classes C20/25 to C50/60.



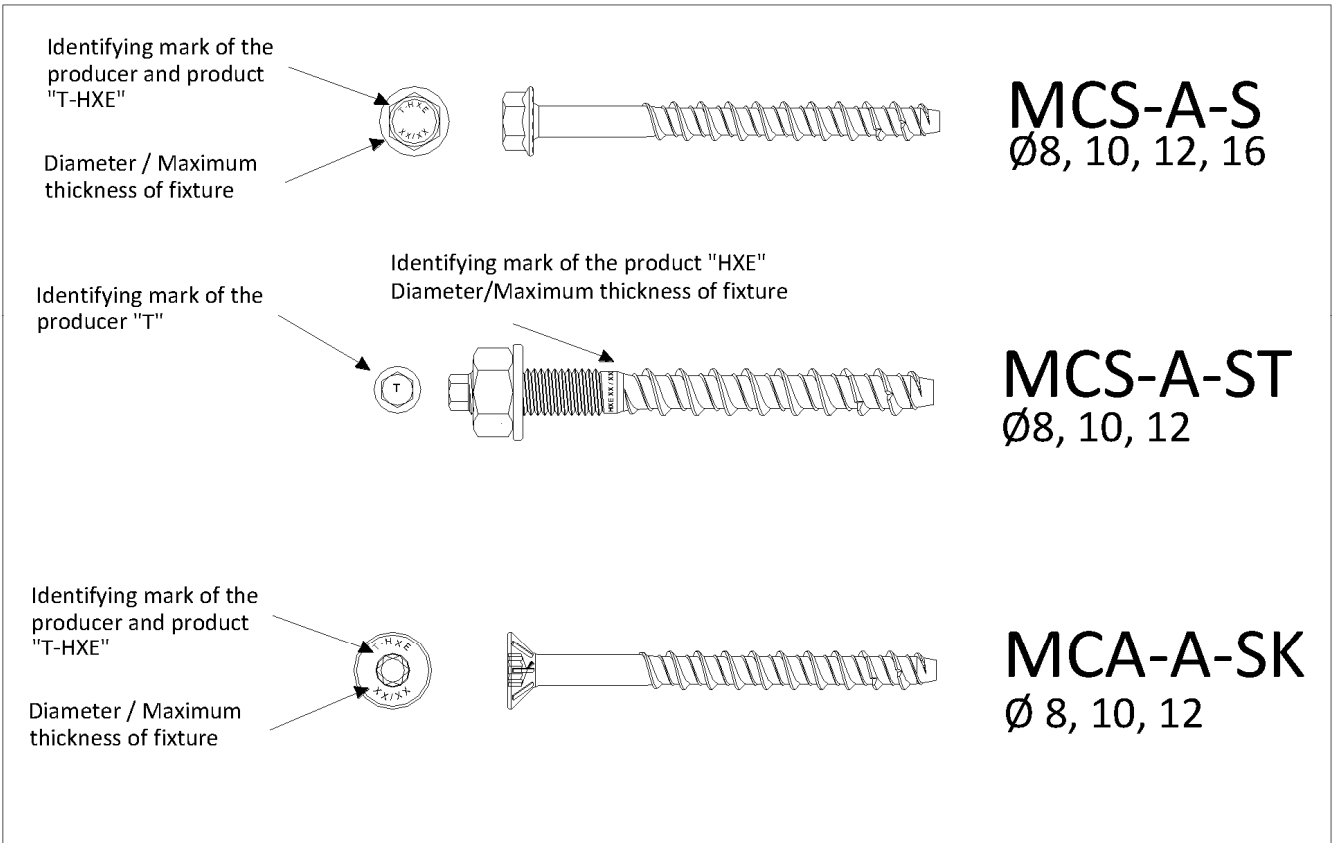
- $d_0$ :** Drill hole diameter
- $d_{ext}$ :** Outside diameter of anchor
- $t_{fix}$ :** Maximum thickness of fixture
- $d_f$ :** Diameter of the clearance hole in the fixture
- $h_{min}$ :** Minimum thickness of concrete member
- $h_1$ :** Depth of the drill hole
- $h_{nom}$ :** Minimum overall embedment depth
- $h_{ef}$ :** Effective embedment depth
- SW:** Wrench size
- AF:** Hexagonal shank size
- T:** Hexalobular socket number
- $T_{INST}$ :** Required torque moment

Mungo Concrete Screw Anchor MCS-A

Product and intended use

Annex 1





The marking of embedment depth is given by the thread itself.

Table 1 : Designation of screw anchor and materials

ITEM	Description	f <sub>y</sub> [MPa]	f <sub>u</sub> [MPa]	Finishing
MCS-A-S	Hexagonal flanged washer head screw	600	750	Materials galvanised ≥ 5µm, according to ISO 4042
MCS-A-ST	Dual thread screw with hexagonal shank, nut and washer according to ISO 7089			
MCS-A-SK	Flat countersunk head with ribs screw			

Mungo Concrete Screw Anchor MCS-A

Designation of anchor parts and materials

Annex 2

Table 2 : Installation parameters MCS-A-S

Denomination		MCS-A-S Ø8/6	MCS-A-S Ø10/8 <sup>1)</sup>	MCS-A-S Ø12/10	MCS-A-S Ø16/14
Nominal drill hole diameter	$d_o = [mm]$	6	8	10	14
Cutting diameter of drill bit	$d_{cut} \leq [mm]$	6.40	8.45	10.45	14.50
Effective anchorage depth	$h_{ef} = [mm]$	48	56	64	85
Depth of drill hole	$h_1 = [mm]$	75	85	100	140
Diameter of clearance in the fixture	$d_f = [mm]$	9	12	14	18
Overall anchor embedment depth in the concrete	$h_{nom} = [mm]$	60	70	80	110
Required torque moment	$T_{inst} = [Nm]$	20	50	80	160
Minimum thickness of concrete member	$h_{min} = [mm]$	100	110	130	170
Outside diameter of anchor	$d_{ext} = [mm]$	8	10	12	16
Wrench size MCS-A-S	$SW = [mm]$	10	13	15	21
Minimum thickness of fixture	$t_{fix} = [mm]$	≥5	≥5	≥	≥5
Minimum length of the anchor MCS-A-S	$L = [mm]$	≥65	≥75	≥85	≥115
Minimum edge distance	$c_{min} = [mm]$	45	50	60	80
	for $s \geq [mm]$	45	50	60	80
Minimum spacing	$s_{min} = [mm]$	45	50	60	80
	for $c \geq [mm]$	45	50	60	80

<sup>1)</sup>e.g. Ø10/8 means the following : outside diameter of the screw anchor is 10 mm, diameter of drill bit is 8 mm

Table 3 : Installation parameters MCS-A-ST

Denomination		MCS-A-ST Ø8/6	MCS-A-ST Ø10/8 <sup>1)</sup>	MCS-A-ST Ø12/10
Nominal drill hole diameter	$d_o = [mm]$	6	8	10
Cutting diameter of drill bit	$d_{cut} \leq [mm]$	6.40	8.45	10.45
Effective anchorage depth	$h_{ef} = [mm]$	48	56	64
Depth of drill hole	$h_1 = [mm]$	75	90	100
Diameter of clearance in the fixture	$d_f = [mm]$	9	12	14
Overall anchor embedment depth in the concrete	$h_{nom} = [mm]$	60	70	80
Required torque moment	$T_{inst} = [Nm]$	20	50	80
Minimum thickness of concrete member	$h_{min} = [mm]$	100	110	130
Outside diameter of anchor	$d_{ext} = [mm]$	8	10	12
Wrench size MCS-A-ST	$SW = [mm]$	13	17	19
Hexagonal shank size MCS-A-ST <sup>2)</sup>	$AF = [mm]$	5	7	8
Minimum thickness of fixture	$t_{fix} = [mm]$	≥5	≥5	≥5
Minimum length of the anchor MCS-A-ST	$L = [mm]$	≥85	≥100	≥113
Minimum edge distance	$c_{min} = [mm]$	45	50	60
	for $s \geq [mm]$	45	50	60
Minimum spacing	$s_{min} = [mm]$	45	50	60
	for $c \geq [mm]$	45	50	60

<sup>1)</sup>e.g. Ø10/8 means the following : outside diameter of the screw anchor is 10 mm, diameter of drill bit is 8 mm

<sup>2)</sup>setting requires an impact screwdriver 18V.

Mungo Concrete Screw Anchor MCS-A

Installation parameters of MCS-A and MCS-A-ST

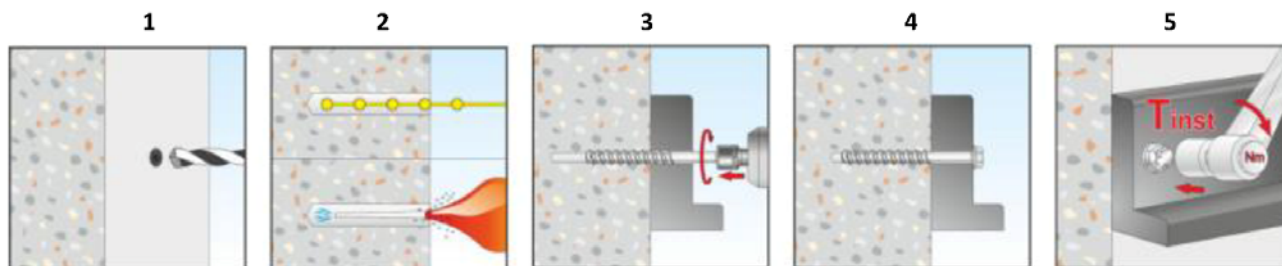
Annex 3

Table 4 : Installation parameters MCS-A-SK

Denomination		MCS-A-SK Ø8/6	MCS-A-SK Ø10/8 <sup>1)</sup>	MCS-A-SK Ø12/10
Nominal drill hole diameter	$d_o = [mm]$	6	8	10
Cutting diameter of drill bit	$d_{cut} \leq [mm]$	6.40	8.45	10.45
Effective anchorage depth	$h_{ef} = [mm]$	48	56	64
Depth of drill hole	$h_1 = [mm]$	75	90	100
Diameter of clearance in the fixture	$d_f = [mm]$	9	12	14
Overall anchor embedment depth in the concrete	$h_{nom} = [mm]$	60	70	80
Required torque moment	$T_{inst} = [Nm]$	20	50	80
Minimum thickness of concrete member	$h_{min} = [mm]$	100	110	130
Outside diameter of anchor	$d_{ext} = [mm]$	8	10	12
Six lobe recess MCS-A-SK	T	T30	T40	T50
Minimum thickness of fixture	$t_{fix} = [mm]$	≥5	≥5	≥5
Minimum length of the anchor MCS-A-SK	$L = [mm]$	≥65	≥75	≥85
Minimum edge distance	$c_{min} = [mm]$	45	50	60
	for $s \geq [mm]$	45	50	60
Minimum spacing	$s_{min} = [mm]$	45	50	60
	for $c \geq [mm]$	45	50	60

<sup>1)</sup>e.g. Ø10/8 means the following : outside diameter of the screw anchor is 10 mm, diameter of drill bit is 8 mm

MCS-A-S installation instructions



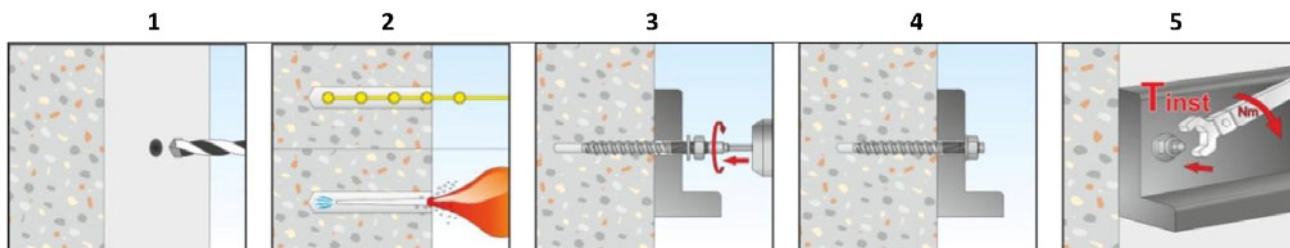
- 1 – Drill a hole in the base material
- 2 – Clean the drilled hole
- 3 – Set the screw in the concrete
- 4, 5 – Apply the required torque moment

Mungo Concrete Screw Anchor MCS-A

Installation parameters of MCS-A-SK and  
Installation instructions of MCS-A-S

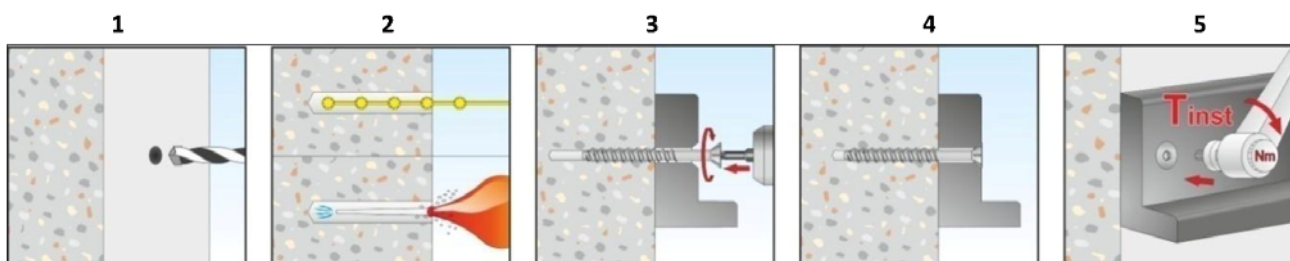
Annex 4

**MCS-A-ST installation instructions**



- 1 – Drill a hole in the base material
- 2 – Clean the drilled hole
- 3 – Set the screw in the concrete
- 4, 5 – Apply the required torque moment

**MCS-A-SK installation instructions**



- 1 – Drill a hole in the base material
- 2 – Clean the drilled hole
- 3 – Set the screw in the concrete
- 4, 5 – Apply the required torque moment

Mungo Concrete Screw Anchor MCS-A

installation instructions of MCS-A-ST and MCS-A-SK

Annex 5

Table 5 : Design Method A, characteristic values to tension loads

Type of anchor / Size			MCS-A Ø8/6	MCS-A Ø10/8	MCS-A Ø12/10	MCS-A Ø16/14
<b>Steel failure</b>						
Characteristic Resistance	$N_{Rk,s}$	[kN]	20	35	50	95
Partial safety factor	$\gamma_{Ms}$		1.5 <sup>2)</sup>			
<b>Pull-out failure</b>						
Effective embedment depth	$h_{ef}$	[mm]	48	56	64	85
Characteristic Resistance in uncracked concrete C20/25	$N_{Rk,p}$	[kN]	16	20	25	40
Characteristic Resistance in cracked concrete C20/25			4	7.5	9	16
Increasing factors for $N_{Rk,p}$ for cracked and uncracked concrete	$\Psi_c$	C30/37	1.22			
		C40/50	1.41			
		C50/60	1.55			
Partial safety factor	$\gamma_{Mp}$		2.1 <sup>4)</sup>	1.8 <sup>3)</sup>	2.1 <sup>4)</sup>	2.1 <sup>4)</sup>
<b>Concrete cone failure and splitting failure</b>						
Effective embedment depth	$h_{ef}$	[mm]	48	56	64	85
Spacing	$s_{cr,N}$	[mm]	3 x $h_{ef}$			
Edge distance	$c_{cr,N}$	[mm]	1.5 x $h_{ef}$			
Spacing (splitting)	$s_{cr,sp}$	[mm]	160	175	195	255
Edge distance (splitting)	$c_{cr,sp}$	[mm]	80	85	95	130
Partial safety factor	$\gamma_{Mp}$		2.1 <sup>4)</sup>	1.8 <sup>3)</sup>	2.1 <sup>4)</sup>	2.1 <sup>4)</sup>

<sup>1)</sup> In absence of other national regulations.

<sup>2)</sup> The partial safety factor  $\gamma_2=1.0$  is included

<sup>3)</sup> The partial safety factor  $\gamma_2=1.2$  is included

<sup>4)</sup> The partial safety factor  $\gamma_2=1.4$  is included

Table 6 : Displacements under tension loads

Type of anchor / Size			MCS-A Ø8/6	MCS-A Ø10/8	MCS-A Ø12/10	MCS-A Ø16/14
Service tension load in uncracked concrete C20/25	N	[kN]	7.62	8.89	11.90	13.61
Displacements	$\delta_{N0}$	[mm]	0.76	0.74	0.63	0.74
	$\delta_{N\infty}$	[mm]	0.29	0.34	0.23	0.41
Service tension load in cracked concrete C20/25	N	[kN]	1.90	4.17	4.29	5.44
Displacements	$\delta_{N0}$	[mm]	0.27	0.39	0.45	0.79
	$\delta_{N\infty}$	[mm]	0.53	0.77	0.97	1.05

Mungo Concrete Screw Anchor MCS-A

Characteristic values of tension loads  
Displacements under tension loads

Annex 6

Table 7 : Design Method A, characteristic values to shear loads

Type of anchor / Size			MCS-A Ø8/6	MCS-A Ø10/8 <sup>1)</sup>	MCS-A Ø12/10	MCS-A Ø16/14
<b>Steel failure without level arm</b>						
Characteristic Resistance	$V_{Rk,s}$	[kN]	9.4	20.1	32.4	56.9
Partial safety factor	$\gamma_{Ms}$		1.5 <sup>2)</sup>			
<b>Steel failure with level arm</b>						
Characteristic bending moment	$M_{Rk,s}^0$	[Nm]	19	44	83	216
Partial safety factor	$\gamma_{Ms}$		1.5 <sup>2)</sup>			
<b>Concrete pry-out failure</b>						
Effective embedment depth	$h_{ef}$	[mm]	48	56	64	85
Factor in equation (5.6) of the guideline Annex C, Section 5.2.3.3	k	-	1	1	2	2
Partial safety factor	$\gamma_{Mp}$		1.5 <sup>2)</sup>			
<b>Concrete edge failure</b>						
Effective anchorage length	$h_{ef}$	[mm]	48	56	64	85
Effective diameter of the anchor	d	[mm]	6	8	10	14
Partial safety factor	$\gamma_{Mc}$	-	1.5 <sup>2)</sup>			

<sup>1)</sup> In absence of other national regulations.

<sup>2)</sup> The partial safety factor  $\gamma_2=1.0$  is included

Table 8 : Displacements under shear loads

Type of anchor / Size			MCS-A Ø8/6	MCS-A Ø10/8 <sup>1)</sup>	MCS-A Ø12/10	MCS-A Ø16/14
Service shear load in cracked and uncracked concrete C20/25	V	[kN]	4.50	9.60	15.40	27.10
Displacements	$\delta_{V0}$	[mm]	0.94	1.47	1.87	3.00
	$\delta_{V\infty}$	[mm]	1.41	2.20	2.81	4.50

Mungo Concrete Screw Anchor MCS-A

Characteristic values of shear loads  
Displacements under shear loads

Annex 7

**Table 9 : Characteristic values to tension loads under fire exposure**

Duration of fire resistance = 30 min, screw anchor MCS-A		Ø8/6	Ø10/8	Ø12/10	Ø16/14
<b>Steel Failure</b>					
Characteristic Resistance	$N_{Rk,s,fi,30}$ [kN]	0.28	0.73	1.51	2.85
<b>Pull-out failure</b>					
Characteristic Resistance in concrete C20/25 to C50/60	$N_{Rk,p,fi,30}$ [kN]	1.00	1.87	2.25	4.0
<b>Concrete cone failure</b>					
Characteristic Resistance in concrete C20/25 to C50/60	$N_{Rk,c,fi,30}$ [kN]	2.87	4.23	5.90	12.0
Duration of fire resistance = 60 min, screw anchor MCS-A		Ø8/6	Ø10/8	Ø12/10	Ø16/14
<b>Steel Failure</b>					
Characteristic Resistance	$N_{Rk,s,fi,60}$ [kN]	0.25	0.64	1.13	2.14
<b>Pull-out failure</b>					
Characteristic Resistance in concrete C20/25 to C50/60	$N_{Rk,p,fi,60}$ [kN]	1.00	1.87	2.25	4.0
<b>Concrete cone failure</b>					
Characteristic Resistance in concrete C20/25 to C50/60	$N_{Rk,c,fi,60}$ [kN]	2.87	4.22	5.90	12.0
Duration of fire resistance = 90 min, screw anchor MCS-A		Ø8/6	Ø10/8	Ø12/10	Ø16/14
<b>Steel Failure</b>					
Characteristic Resistance	$N_{Rk,s,fi,90}$ [kN]	0.19	0.49	0.98	1.85
<b>Pull-out failure</b>					
Characteristic Resistance in concrete C20/25 to C50/60	$N_{Rk,p,fi,90}$ [kN]	1.00	1.87	2.25	4.0
<b>Concrete cone failure</b>					
Characteristic Resistance in concrete C20/25 to C50/60	$N_{Rk,c,fi,90}$ [kN]	2.87	4.22	5.90	12.0
Duration of fire resistance = 120 min, screw anchor MCS-A		Ø8/6	Ø10/8	Ø12/10	Ø16/14
<b>Steel Failure</b>					
Characteristic Resistance	$N_{Rk,s,fi,120}$ [kN]	0.14	0.39	0.75	1.43
<b>Pull-out failure</b>					
Characteristic Resistance in concrete C20/25 to C50/60	$N_{Rk,p,fi,120}$ [kN]	0.8	1.5	1.8	3.20
<b>Concrete cone failure</b>					
Characteristic Resistance in concrete C20/25 to C50/60	$N_{Rk,c,fi,120}$ [kN]	2.30	3.38	4.72	9.59
Spacing	$s_{cr,N}$	<b>4 x h<sub>ef</sub></b>			
	$s_{min}$	45	50	60	80
Edge distance	$c_{cr,N}$	<b>2 x h<sub>ef</sub></b>			
	$c_{min}$	c <sub>min</sub> = 2xh <sub>ef</sub> ; If fire attack comes from more than one side, the edge distance of the anchor has to be ≥ 300 mm or ≥ 2 x h <sub>ef</sub>			

In absence of other national regulations the partial safety factor for resistance under fire exposure  $\gamma_{m,fi} = 1.0$  is recommended

Mungo Concrete Screw Anchor MCS-A

Characteristic values to tension loads under fire exposure

Annex 8



Table 10: Characteristic values to shear load under fire exposure

Duration of fire resistance = 30min, screw anchor MCS-A			Ø8/6	Ø10/8	Ø12/10	Ø16/14
<b>Shear load without lever arm</b>						
Characteristic resistance	$V_{Rk,s,fi,30}$	[kN]	0.28	0.73	1.51	2.85
<b>Shear load with lever arm</b>						
Characteristic bending resistance	$M_{Rk,s,fi,30}$	[Nm]	0.24	0.87	2.22	5.76
Duration of fire resistance = 60min, screw anchor MCS-A			Ø8/6	Ø10/8	Ø12/10	Ø16/14
<b>Shear load without lever arm</b>						
Characteristic resistance	$V_{Rk,s,fi,60}$	[kN]	0.25	0.64	1.13	2.14
<b>Shear load with lever arm</b>						
Characteristic bending resistance	$M_{Rk,s,fi,60}$	[Nm]	0.22	0.75	1.66	4.32
Duration of fire resistance = 90min, screw anchor MCS-A			Ø8/6	Ø10/8	Ø12/10	Ø16/14
<b>Shear load without lever arm</b>						
Characteristic resistance	$V_{Rk,s,fi,90}$	[kN]	0.19	0.49	0.98	1.85
<b>Shear load with lever arm</b>						
Characteristic bending resistance	$M_{Rk,s,fi,90}$	[Nm]	0.17	0.58	1.44	3.74
Duration of fire resistance = 120min, screw anchor MCS-A			Ø8/6	Ø10/8	Ø12/10	Ø16/14
<b>Shear load without lever arm</b>						
Characteristic resistance	$V_{Rk,s,fi,120}$	[kN]	0.14	0.39	0.75	1.43
<b>Shear load with lever arm</b>						
Characteristic bending resistance	$M_{Rk,s,fi,120}$	[Nm]	0.12	0.46	1.11	2.88
<b>Concrete pry-out failure</b>						
The characteristic resistance $V_{rk,cp,fi,Ri}$ in concrete C20/25 to C50/60 is determined by: $V_{Rk,c,fi(90)} = k \times N_{Rk,c,fi(90)} (\leq R90)$ and $V_{Rk,c,fi(120)} = k \times N_{Rk,c,fi(120)}$ (up to R120)						
Factor k	k	-	1	1	2	2
<b>Concrete edge failure</b>						
The characteristic resistance $V_{rk,cp,fi,Ri}$ in concrete C20/25 to C50/60 is determined by $V_{Rk,c,fi(90)}^0 = 0.25 \times V_{Rk,c}^0$ (R30, R60, R90) and $V_{Rk,c,fi(120)}^0 = 0.20 \times V_{Rk,c}^0$ (R120) with $V_{Rk,c}^0$ as an initial value of the characteristic resistance of a single anchor in cracked concrete C20/25						

In absence of other national regulations the partial safety factor for resistance under fire exposure  $\gamma_{m,fi} = 1.0$  is recommended

Mungo Concrete Screw Anchor MCS-A

Characteristic values to tension loads under shear exposure

Annex 9