Operating Instructions EDm Motor Drive
(to use with DYNA Z Pull-Off and Extraction Tester)

ISO 9001

proceq

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Subject to change without notice

Contents

1 Safety

1.1 General Instructions

Please read these operating instructions prior to placing in operation for the first time. They contain important instructions on the safety, use and maintenance of the EDm motor drive and the related components.

1.2 Liability

Our "General Terms and Conditions of Sales and Delivery" always apply. Warranty and liability claims for injuries and damage to property are excluded if they result from one or more of the following causes:

- Incorrect use of the EDm motor drive and the related components
- Improper use of functions, operation or maintenance of the EDm motor drive and the related components
- Failure to observe the instructions in the operating instructions in relation to the use of functions, operation and maintenance of the EDm motor drive and the related components
- Unauthorised modifications to the EDm motor drive and the related components
- Disasters caused by the action of foreign bodies, accidents, vandalism and acts of God

1.3 Safety Instructions

1.3.1 General

- Carry out the stipulated maintenance properly and at the correct time.
- Following completion of the maintenance tasks, perform a functional check
  (see 7 Maintenance and 3 Placing in Operation).

1.3.2 Unauthorized Operators

Children and persons under the influence of alcohol, drugs or medication are not allowed to operate the EDm motor drive and the related components. Persons who are not familiar with the operating instructions are only allowed to operate the motor drive under the supervision of a person familiar with the device.

1.3.3 Safety Symbols

The following symbols are given with all important safety instructions in these operating instructions.

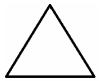
Danger!
This instruction provides information on a risk of injury and/or serious injury if specific rules of conduct are not observed.

Attention!
This instruction warns you about equipment and material damage as well as possible financial and legal implications (e.g. loss of guarantee, potential liability, etc.).

Here you will find important instructions and information

1.4 Correct Use

The motor drive is an electromechanical device and is used for driving the DYNA Z pull-off and extraction testers. Using this device a continuous increase in load as per the standards can be generated.



Attention!
The motor drive and the related components are not water-proof. Do not use under water. If devices are wet by water spray, wipe dry immediately.

1.5 Reference Standards and Regulations

ASTM D 4541-02, 2002
DIN EN 24624, 1992
DIN EN 1348, 1999
DIN EN 1542, 1998
PrEN 12504-3, in preparation
ASTM C90-01
DIN 1048, 1991
ZTV-SIB 90, Annex 2
DIN EN 1015-12

2 Product Descriptions

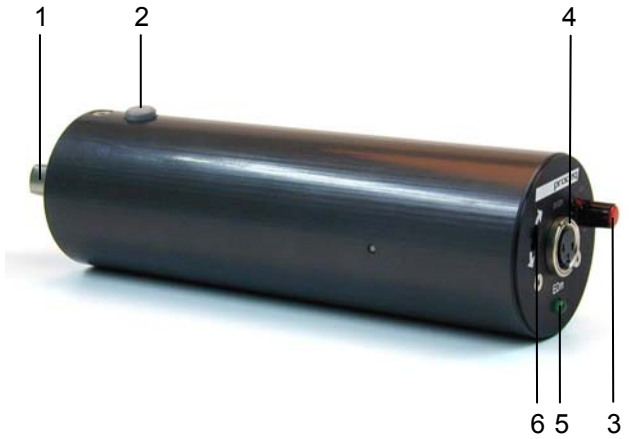
2.1 Applications

The EDm motor drive for a DYNA Z pull-off or extraction tester can be used if a continuous increase in load is required (e.g. due to requirements in the applicable standards). The motor drive is used for operating the hydraulic pump instead of the hand crank supplied with the DYNA Z testers.

Compared to the hand crank, the drive has the advantage that a specific rate of increase in the load can be achieved.

For information on the operation of the DYNA Z … and DYNA Z …S pull-off and extraction testers, please refer to the operating instructions for these devices.

2.2 EDm Motor Drive: Controls



1 Drive socket with 10x10 internal square drive
2 ON button
3 Voltage regulator (2.4-12 VDC)
4 Connector (supply max. 15 VDC)
5 Battery charge state indicator
6 Switch forward - backward

Fig. 2.01 EDm motor drive

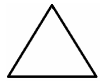
2.3 Technical Data

Supply:	max. 15 VDC only DC, no AC
Voltage at the motor:	2.4 to 12 VDC
Speed:	2.0 to 11.7 rpm
Torque:	max. 3 Nm
Current consumption:	max. 690 mA at full load
Battery charge:	
state indicator:	LED illuminates at 8.5 VDC and above
Direction of rotation:	- forward, speed and loading rate increase as per voltage setting (3) - backward, always at full speed
On button:	when not operated, OFF
Dimensions:	housing Ø61 +/-1 x 202.5
[mm]	245 (incl. drive socket and rotary knob) Drive socket outside Ø14 x 30 Inside 10 x 10

2.4 Power Supply

The EDm motor drive is supplied using an external power supply (for details see 6 Power supplies) that is connected to the drive using a connecting cable.

The motor drive must be operated with DC, the maximum voltage is 15 VDC.



Attention!
If the motor drive is operated with more than 15 VDC or AC, damage to the electronics is to be expected.

3 Installation Guide

1 Read the operating instructions carefully
2 Connect power supply, max. 15 VDC (see 6 Power supplies)
3 Set direction of rotation (see 4.1 Direction of rotation) forward → clockwise, backward ← anti-clockwise
4 Perform function test – forward with various voltage settings (speeds) and backward (motor always runs at full speed). (To switch on press the ON button (2))

4 Settings

For the EDm motor drive, the loading rate increase can be adjusted using the voltage regulator (3) (The speed of the drive socket is proportional to the voltage).

4.1 Direction of Rotation

The direction of rotation can be set using the switch (6) (observe arrow symbols).

Forward (measuring) corresponds to clockwise rotation (switch (6) up). The voltage at the motor is only reduced to the voltage set at the rotary knob (3) when the switch (6) is in this position.

Backward (place pump in initial position) corresponds to anticlockwise rotation (switch (6) down). In this switch position the drive always rotates at full speed.

4.2 Setting the Loading rate increase

The required loading rate increase can be adjusted by means of the voltage regulator (3). The adjusted voltage (from 2.4 V to 12 V) corresponds to the voltage at the motor operating in forward mode, (clockwise).

Fig. 4.01 Front plate of EDm motor drive

For each type of DYNA Z tester, the ratio between the loading rate increase and the regulated voltage is different.

In the following are settings for DYNA Z.. and DYNA Z…E pull-off testers, as well as DYNA Z..S, DYNA Z..SE and DYNA Z...Fs extraction testers.

4.2.1 DYNA Z16 Pull-Off Tester

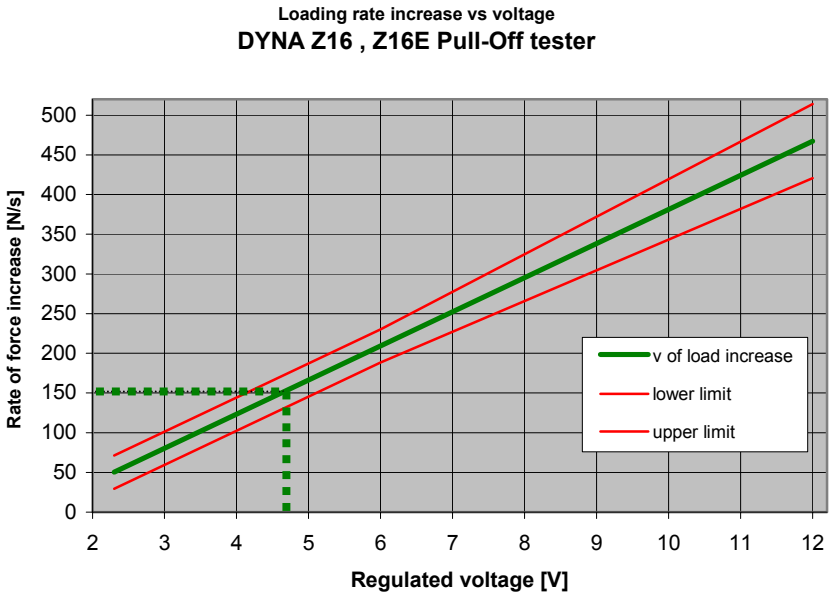


Fig. 4.02 Voltage setting for DYNA Z16, Z16E Pull-Off Tester

Formula:

v = 43.0*U – 48.7

v = Loading rate increase [N/s]

U = Regulated voltage [VDC]

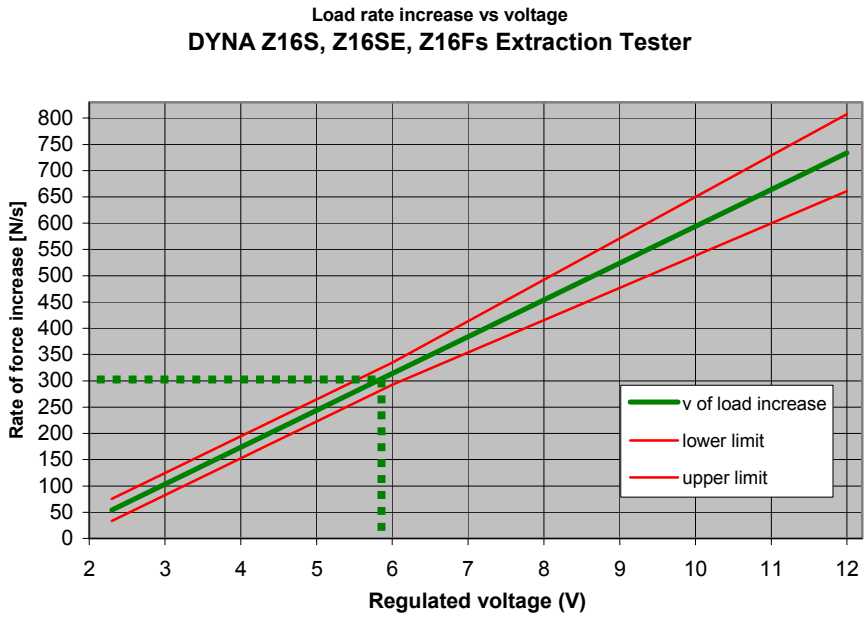
Accuracy:

6 to 12 VDC: **±** 10%

2.3 to 6 VDC: **±** 21 N/s

Example:
For v = 150 N/s
Set U = 4.6 VDC

4.2.2 DYNA Z16S, Z16SE, Z16Fs Extraction Tester



Formula:

v = 70.1*U – 107.0

v = Loading rate increase [N/s]

U = Regulated voltage [VDC]

Accuracy:

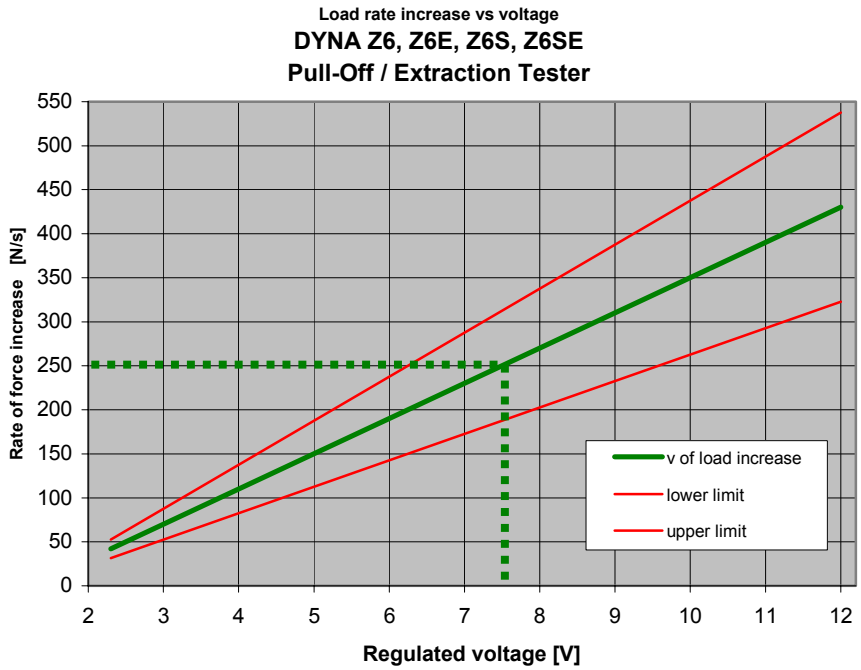
6 to 12 VDC: **±** 10%

2.3 to 6 VDC: **±** 32 N/s

Example:
For v = 300 N/s
Set U = 5.8 VDC

Fig. 4.03 Voltage setting for DYNA Z16S, Z16SE, Z16Fs Extraction Tester

4.2.3 DYNA Z6, Z6E, Z6S, Z6SE Pull-Off and Extraction Tester



Formula:

v = 40.0*U – 49.9

v = Loading rate increase [N/s]

U = Regulated voltage [VDC]

Accuracy:

2.3 to 12 VDC: ± 25%

Example:
For v = 250 N/s
Set U = 7.5 VDC

Fig. 4.04 Voltage setting for DYNA Z6, Z6E, Z6S, Z6SE Pull-Off and Extraction Tester

4.2.4 Accuracy

Measurement accuracy space is influenced by two factors:

- EDm motor drive in combination with the individual DYNA Z-instrument as shown in the figures 4.02, 4.03 and 4.04
- Manual voltage setting of ± 0.3V

The combination of the EDm motor drive with the DYNA Z causes the lower accuracy, thus especially for the DYNA Z testers with a nominal load of 6 kN (see figure 4.04).

If a higher accuracy is required, we recommend plotting a test curve using WIGAonline software (see 8.2 Accessories) that will plot the gradient for the loading rate increase (see 8.4 Individual setting curve). In this way the rate can be set exactly as the repetition accuracy (combination DYNA Z tester and EDm motor drive) is good to max. 5%.

If a DYNA Z tester to be used after a long period without use, the device must be loaded once to nominal load and then unloaded. Only then the repetition accuracy is as described above. This step is recommended each time prior to placing the tester in operation.

4.3 Operating Limits

The voltage regulator keeps the voltage constant at the value set (between 2.4 and 12 V) on condition that the supplied voltage is at least 0.3 V higher as the voltage to be set, due to the voltage drop in the voltage regulator of approx. 0.3 V.

For usual tests, with lower rates of load increase as the one mentioned in 5.2 Battery Charge State Indicator and with the LED (5) on, the loading rate increase is kept at the value set.

In case of unusual tests with a higher loading rate increase as the one mentioned in 5.2 Battery Charge State Indicator, new batteries should be used and the effective battery voltage must be measured. During the whole test, the effective voltage must be at least 0.3 Volt higher as the voltage set with the regulator.

5 Measuring

5.1 Measurement Process with DYNA Z and EDm Motor Drive

1 Measurement process (incl. preparation of probe) as described in the operating instructions for the DYNA Z pull-off / extraction tester.
Prepare the EDm motor drive (see 3 Placing in operation as well as 4.2.5 Accuracy / note).

2 Set required loading rate increase as per formula or diagram (see 4.2 Setting the Loading rate increase) using voltage setting (3).

3 Fit EDm motor drive to 10x10 square drive instead of hand crank.

4 Hold drive firmly and switch on by pressing the On button (2). Keep On button (2) pressed until the sample fractures or until the required load or nominal load of the tester is reached.

Attention!
Do not load the DYNA Z tester beyond the nominal load (brief overload of 10% is allowed)

5 When the pump stop is reached (whether forward or backward), immediately switch off drive by releasing the On button (2).

Attention!
The EDm motor drive and the DYNA Z tester do not have overload protection!

The EDm motor drive is primarily designed for the DYNA Z6 and Z16 testers. With these testers it is possible to apply the EDm motor drive up to the nominal load without problems.

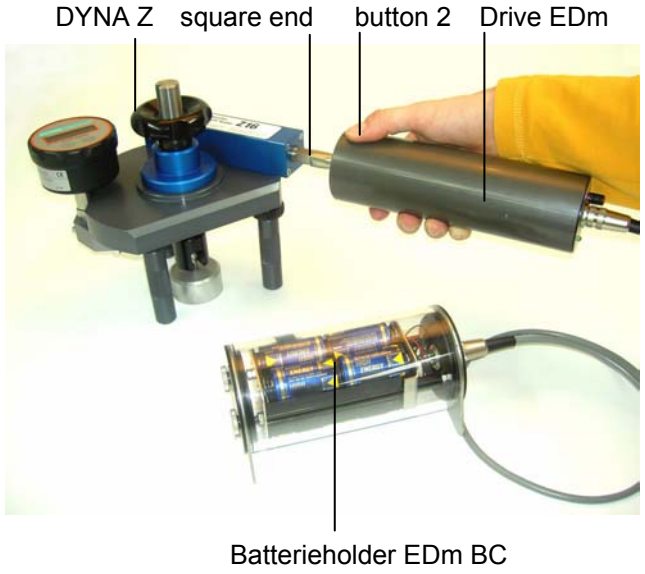


Fig. 5.01 Measurement with DYNA Z and EDm motor drive

5.2 Battery Charge State Indicator

The green light emitting diode (5) illuminates when the motor is rotating (ON button (2) pressed) and the supply voltage is more than 8.5 V. This corresponds to a loading rate increase of around:

320 N/s for DYNA Z16, Z16E

490 N/s for DYNA Z16S, Z16SE, Z16Fs

290 N/s for DYNA Z6S, Z6E, Z6S, Z6SE

If the LED goes out (i.e. the supply voltage is less than 8.5 V) the batteries should be replaced or the power supply charged.

5.3 Typical Loading rate increase Curve

The increase in the load is not linear at the start as first all the play and static friction must be overcome.

The gradient of the linear curve is the loading rate increase v. In the example of figure 5.02, with
F = 0.3082*t – 18.82 = v*t – 18.82, the loading rate increase becomes
v = F/t = 0.3082 kN/s = 308.2 N/s.

F = Load [kN]
t = Time [s]
v = Loading rate increase [kN/s]

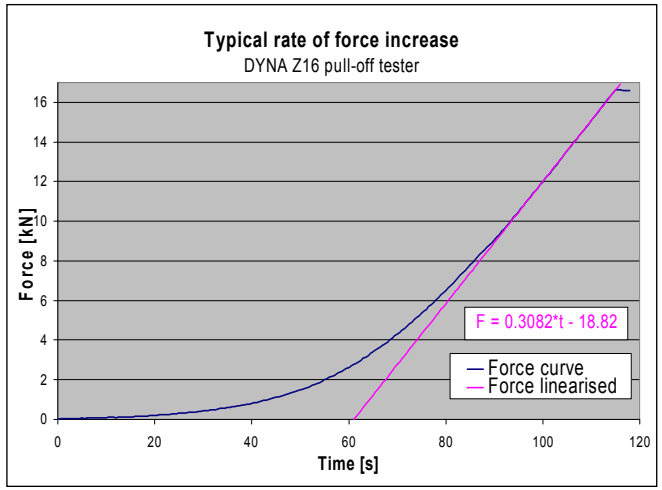


Fig. 5.02 Typical Curve of load increase

5.3 Overheating

For lower rates of load increase, i.e. voltages between 2.3 and 4 V, the temperature increase inside the motor may be up to 40 degrees Celsius due to the necessary throttling of the EDm motor drive.

To avoid overheating of the EDm motor drive, do not operate the motor in this throttling mode (2.3 V to 4 V) if outside temperature exceeds 40 degrees Celsius.

6 Power Supplies

Attention!
The EDm motor drive is only allowed to be supplied with DC to maximum 15 VDC.

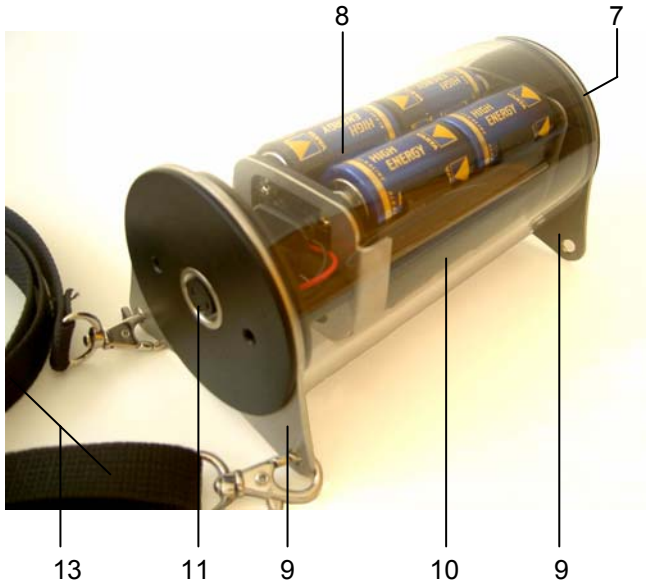
The EDm motor drive can in principle be supplied in three ways:

- Batteries
- Power supply or
- Special supply unit

6.1 EDm BC Battery Holder

The EDm BC battery holder supplies the EDm motor drive using eight 1.5 V batteries that, connected in series, produce 12 VDC.

The battery holder is not suitable for the use of rechargeable batteries as when fully charged these only produce 1.2 V each and thus only yield a supply voltage of 9.6 VDC instead of 12 VDC.



7 Knurled nut
8 Baby cells type C voltage 1.5 VDC (LR14)
9 Foot
10 Transparent housing sleeve
11 Device connector, 2-pin
(miniature round connector, series 680)
12 Connecting cable (see 6.2
EGS 1800 power supply and 8.2 Accessories)
13 Carry strap

Fig. 6.01 EDm BC Battery holder

6.1.1 Connecting the EDm BC Battery Holder

Connect the battery cable (12) to the connectors on the EDm BC battery holder and EDm motor drive. The battery holder and the motor drive have the same threaded connector (see point 11 Section 6.1 or point 4 Section 4). When making the connections ensure that the groove on the socket is aligned with the lug on the plug.

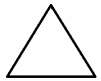
6.1.2 Operating Time

The EDm motor drive can be operated for approx. 25 hours with batteries of type C (Baby).

Exact information on the operating time is not possible as the operating time is heavily dependent on the current supplied to the motor, which in turn can vary significantly depending on the load.

6.1.3 Changing the Batteries

1 Undo the two knurled nuts (7).
2 Pull battery block cover incl. foot (9), device connector (11) and batteries (8) from the housing sleeve(10).
3 Replace batteries (8).



Attention!
Ensure that the polarity is correct.

4 Slide entire battery block into the housing sleeve (10).
5 Fit rear cover with rear foot (9) to threaded rods.
6 Tighten the two knurled nuts (7) (before tightening place the battery holder on a flat surface on its feet so that the feet are correctly aligned).

6.2 EGS 1800 Power Supply

PROCEQ also supplies the EGS 1800 power supply from Einhell. To connect the power station to the EDm motor drive you will need in addition to the normal connecting cable (12), an adapter cable (14).

Refer to the separate operating instructions for information on the operation of the EGS 1800 power supply.

Fig. 6.02 Power supply EGS 1800

6.2.1 Connecting the EGS 1800 Power Supply

The adapter cable (14) (for picture also see 8.2 Accessories) provides the appropriate connection between the EGS 1800 power supply and the connecting cable. One end of the adapter cable is to be connected to the threaded connector on the connecting cable (ensure that the groove on the socket is aligned with the lug on the plug) and the other end to the "cigarette lighter connector" on the EGS 1800. Using this cable the motor drive can also be connected to the cigarette lighter connector in a car.

6.2.2 Operating Time

Using the EGS 1800 power supply the operating time is approx. 36 hours.

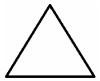
Exact information on the operating time is not possible as the operating time is heavily dependent on the current supplied to the motor, which in turn can vary significantly depending on the load.

6.3 Laboratory Power Supply / Mains Power Supply

If the motor drive is to be operated from a laboratory power supply / mains power supply, we recommend the use of a linear power supply, as otherwise measurement interference may result.

To connect a laboratory power supply / mains power supply, a special connecting cable is required.

If a switched laboratory power supply is used, interference may be produced that will cause measuring errors.



Attention!
When power supplies are used, ensure that the voltage is set to maximum 15 VDC and that the EDm motor drive is never supplied with AC.

Standard power supplies often have a high internal resistance. When the EDm motor drive is supplied, considerable current (up to 460 mA) is drawn that can result in a significant voltage drop.

6.3.1 Connecting any other Power Supply

To connect other power supplies, special connecting cables or adapters are required that are not standardised. PROCEQ can provide assistance in finding a specific solution.

6.3.2 Operating Time

As long as the power supply is switched on or if it has capacitance, the drive can be operated.

7 Maintenance

In principle the components used in the EDm motor drive and the EDm BC battery holder are maintenance-free. In case of soiling, please clean.

Attention!
When cleaning, please do not hold the device under running liquid or immerse it in a liquid, as the EDm motor drive and its accessories are not water-proof. Do not use abrasive cleaning agents.

A moist cloth or a cloth soaked in alcohol can be used for cleaning.

Danger!
Undo all cable connections prior to cleaning.

7.1 Storage

All components are to be stored in a dry place, if possible free of dust.

If the device is not to be used for an extended period, the batteries are to be removed from the EDm BC battery holder.

8 Data

8.1 Form of Supply

8.1.1 EDm Motor Drive with EDm BC Battery Holder

- EDm motor drive
- EDm BC battery holder
- Connecting cable
- Carry strap

Item no. 345 09 220

Fig. 8.01 EDm motor drive with EDm BC battery holder

8.2 Accessories

EDm motor drive
with drive socket
item no. 345 09 223

EDm BC
battery holder
with carry strap
item no. 345 09 224

EGS 1800
power station
without adapter cable
item no. 345 09 225

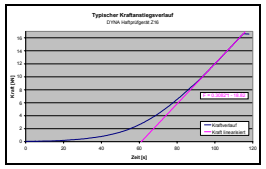
EGS 1800
power station
with adapter cable
item no. 345 09 221

Connecting cable
EDm / EDm BC
item no. 345 09 226

Adapter cable
for EGS 1800
item no. 345 09 227

Drive socket
for EDm motor drive
item no. 345 09 228

Carry strap
for EDm BC
item no. 345 09 229



WIGAonline software
item no. 380 01 243

Fig. 8.02 to Fig. 8.09 Accessories

8.3 Calibration

The EDm motor drive can be calibrated together with a DYNA Z pull-off or extraction tester by a PROCEQ-certified service centre.

The device should be calibrated once a year.

8.4 Individual Setting Curves

For each combination of EDm motor drive with DYNA Z instrument, an individual setting curve can be determined. With this, the accuracy of the speed setting for the load increase can be improved (see **4.2.4** accuracy).

The curve must be determined using at least four points. For this, we recommend setting the voltage on the EDm motor drive to 2.4 V, 5 V, 8 V and 12 V. For each voltage a test must be performed to get the typical curve of load increase (with WIGAonline software or manually with the stop watch) and to determine the speed in N/s of the linear portion of the curve (see 5.3 Typical Loading rate increase Curve). The linear portion of the curve is approximately between 4 to 6 kN for DYNA Z instruments with 6 kN nominal load and approximately between 9 to 16 kN for DYNA Z instruments with 16 kN nominal load.

The measured values of loading rate increase in N/s vs voltage in V can be entered into an Excel sheet.

The setting curve can then be determined using the feature of the trend curve in Excel as follows:

- Mark the pair of values in the Excel sheet
- Click the cursor on the icon “curve” and then right click the mouse
- Add trend curve, linear option and show equation in the figure
- Take the loading rate increase from the equation