Torque Control.

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Content
Torque Control.

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MATADOR torque technique.
The basics of controlled tightening.
Whenever it must be safe.

Controlled tightening is the standard of today.

In order to save raw materials, weight and costs, in modern assembly technology screws become more and more small and lightweight. At the same time the requirements increase in terms of durability of a screw connection.

Nowadays for nearly 100% of all industrial screw connections controlled tightening is required.

Controlled means with a predefined torque value or torque angle, so that the remaining clamp force ensures the operating safety of the screw connection.

Screw connections are very complex physical processes influenced by numerous variables. The most important factors that determine the quality of a screw connection are torque, clamp force, friction and joint hardness. Only the knowledge and consideration of all four influencing factors will lead to really safe and reliable screw connections.

What is torque? Force times distance.

Torque is derived from the physical factors "force times distance" applied to a rotating movement: The longer the distance and/or the higher the force, the higher the rotary force and thus the torque.
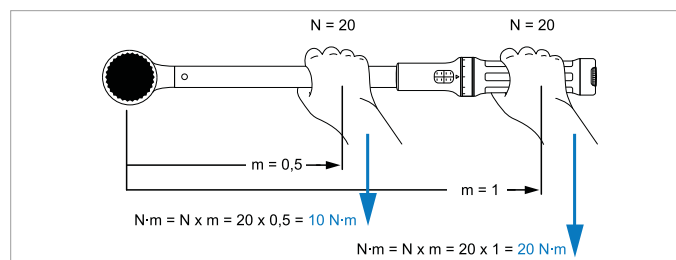
The metric unit that is mainly used to measure torque is newton meter (abbr. N·m). According to this Force F (N) x Lever Arm L (m) = Torque M (N·m).
Torque wrenches measure the force

$$M = F \cdot r$$

that is applied to a screw connection – nothing less, but unfortunately also nothing more.

It is not only length that matters.

Based on the lever rule it is essential that torque wrenches are only operated using the handle. An extension or shortening of the lever arm leads to changed torque values.

This applies for all torque wrenches, unless stated otherwise. E.g. the MATADOR 6174 series torque wrenches with close gap release allow tightening from any position without any value shifts.

In most cases classic torque wrenches are appropriate in order to achieve a controlled manual tightening of screw connections with an adequate accuracy.

Due to friction 90% of applied forces get lost.

But as soon as an optimal and safe screw connection is essential, manual torque wrenches are no longer appropriate. The applied torque is not equal to the reached clamp force and the measured values are thus too inaccurate.
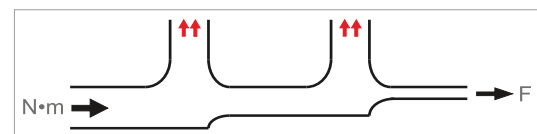
The largest instability factor during tightening is friction that occurs at the thread and below the screw head.

The force known as clamp force, that is supposed to be reached by means of a screw connection, generates a clamping pressure between the screwed workpieces.

The pressure leads to an increased friction between the workpieces and prevents them from coming loose unintentionally. However, these friction forces work against the torque, i.e. they prevent the applied torque from being converted into clamp force to its full extent. Only ~10% of the applied torque is transformed into clamp force.

Torque angle instead of torque value.
The better choice when it really counts.
Optimal clamp force without friction losses. To ensure that you get out what you put in.

N•m

Clamp force

Head friction

Thread friction

Tension force

Clamp force
ca. 10%

Head friction
50-55%

Thread friction
35-40%

N•m

F
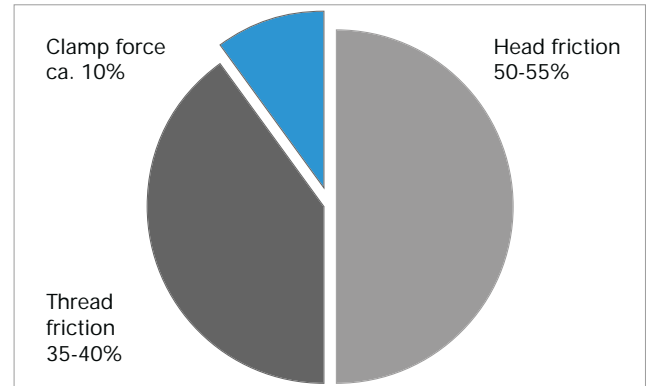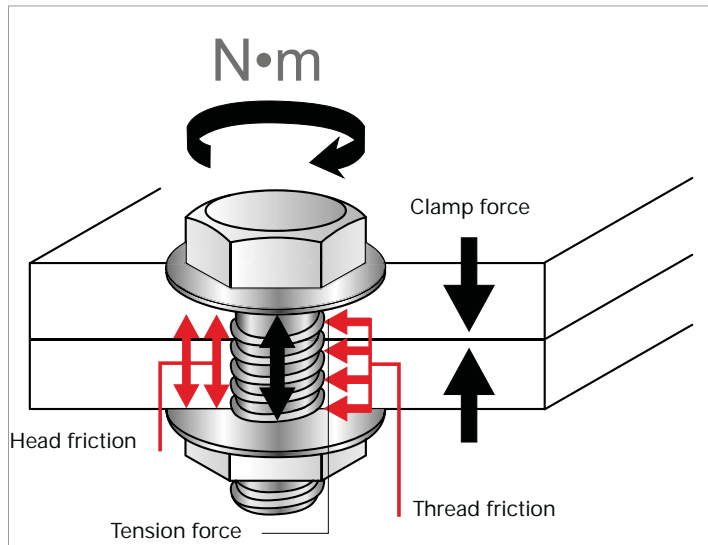
Higher level of accuracy through torque angle.

Minimizing friction to a minimum level.

Each screw is different.

Torque technique for professionals.

In order to achieve a higher level of accuracy also during manual tightening, nowadays – especially in automotive industry – mainly angle-controlled tightening processes are applied.

After being positioned on a workpiece every screw can rotate to a certain extent until its end torque is reached.
This rotation is measured in angular degrees. In case the torque angle between positioning and end torque is low this is called a hard joint (e.g. for metal fittings). In case the angle is high this is called a soft joint (e.g. for wood fittings).

A general rule says that the softer the joint the higher the friction losses and the lower the reached clamp force.

The MATADOR PRO PLUS torque angle wrenches provide a remedy and help the user to reach the optimal clamp force by displaying the torque angle.

During angle-controlled tightening the screw is first tightened to a predetermined trigger torque value – just like during torque-controlled tightening. From this trigger torque value onwards the screw is further rotated by a preset torque angle. The cut-out torque is monitored and documented via internal memory or PC interface.

When torque angle tightening is applied correctly the screw is specifically moved into its plastic deformation. In order to reduce the spreading of the clamp force as far as possible the screw is usually tightened beyond its elastic limit.

If during angle-controlled tightening the screw is only strained within the elastic range the friction is very high and the clamp force spreads accordingly - just like during torque-controlled tightening. Thus exact knowledge about the employed screw is vital.

Required torque and torque angle are mostly stated in the directives for the respective joint.

One has to consider that for angle-controlled tightening only special anti-fatigue bolts with sufficient grip length should be used. Screws that have been used for angle-controlled tightening should not be reused since their strength can be reduced.

No matter how accurate a screw connection is to be tightened: MATADOR has the right torque tools for every case of application.

Starting from simple torque wrenches for semi-professional use up to electric torque/torque angle wrenches – all from a single source.

We will be pleased to assist you.

from 1...	x Factor=	to...	from 1...	x Factor=	to...
Metric measure units					
N·m	0.001=	kN·m	kN·m	1000=	N·m
N·m	0.000001=	MN·m	MN·m	1000000=	N·m
N·m	0.101972=	kpm	kpm	9.80665=	N·m
N·m	1000=	dyn·cm	dyn·cm	0.00100=	N·m
American and British measure units					
N·m	8.850746=	lbf·in (pound force inch)	lbf·in	0.112985=	N·m
N·m	0.737562=	lbf·ft (pound force feet)	lbf·ft	1.355818=	N·m
N·m	141.611930=	ozf·in (ounce force inch)	ozf·in	0.007062=	N·m
N·m	11.800994=	ozf·ft (ounce force feet)	ozf·ft	0.084739=	N·m
N·m	284.764320=	pdl·in (poundal inch)	pdl·in	0.003512=	N·m
N·m	23.730360=	pdl·ft (poundal feet)	pdl·ft	0.042140=	N·m

Torque Conversion Factors

The right torque wrench.
## It depends on the case of application.

Dial type or click type?

Dial type torque wrenches indicate the value of the applied torque via a mechanical scale or a dial gauge.

As soon as the target torque is reached the user has to stop exerting additional force on the torque wrench. Dial type torque wrenches are quick and easy to operate and but they are not as accurate as click type torque wrenches.

At click type torque wrenches the target torque value is set via a scale at the handle. As soon as the set target torque value is reached the wrench indicates this by a palpable and audible signal.

In MATADOR torque wrenches the measuring elements made of spring steel are only loaded during tightening. Thus the torque wrench does not need to be reset and the wrench is immediately ready to continue operation.
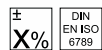
With or without calibration certificate?

According to DIN EN ISO 6789 torque wrenches are measuring instruments that - in certified companies – are subject to a constant monitoring.

The calibration certificate documents the admissible tolerance a torque wrench reaches if it is loaded 5 000 times in each direction of use with the max. value. Depending on the wrench type DIN EN ISO 6789 demands a max. tolerance of ±6% up to ±4%.
After 12 months of use or 5000 load changes a re-calibration of the torque wrench is required.

MATADOR Service.

MATADOR's inexpensive calibration service includes the standard factory certificate according to DIN EN ISO 6789 and on demand also the certificate according to DKD guidelines. We maintain and calibrate MATADOR torque wrenches within 5 days after receipt according to DIN EN ISO 6789 including factory certificate and test badge.

Which drive?

Torque is applied either via the square drive which is used with standard sockets or via a rectangular tool holder (9 x 12 or 14 x 18 mm) for exchangeable insert tools.

When using insert tools it is important to consider that the length of the insert tool corresponds to the set depth gauge. Otherwise the displayed values and the setting values have to be adjusted due to the differing length.
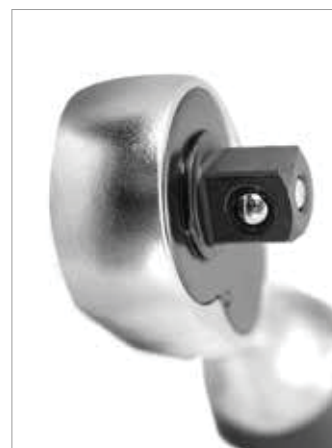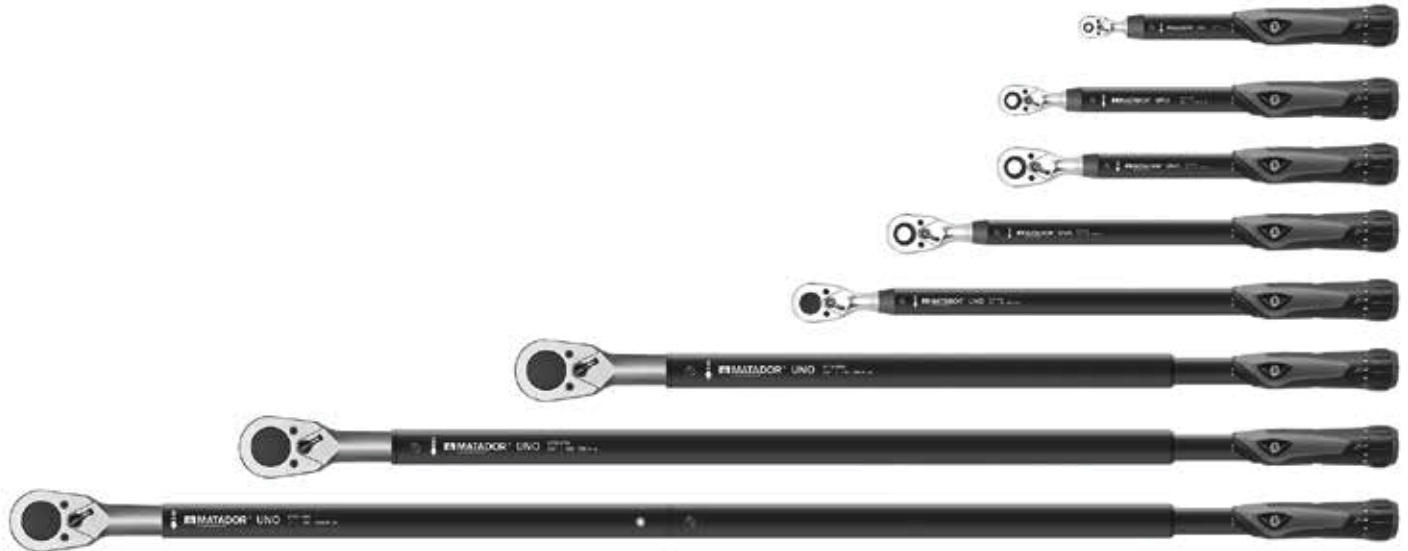

Calibration certificate MATADOR

Overview.
Torque wrenches from 0.1 - 2000 N·m.
Reduction to the essential.

MATADOR®
SCHRAUBWERKZEUGE

Dial or click type. From 6.3 (1/4") up to 25 (1") square drive.
With or without angle function. From 5% up to 3% tolerance according to DIN EN ISO 6789. Always with calibration certificate. It is your choice.

MATADOR Torque Wrenches at a glance.

Art. Code	Model	Art. Grp.	Short description	Type	Tolerance	Standard	Measuring range in N·m		mm	"
6170 0010		6170	Torque Screwdriver for fine mechanics	click	± 5%	DIN EN ISO 6789	0,1	- 1,2	6,3	1/4
6170 0020							1,0	- 6,0	6,3	1/4
6172 0010		6172	Torque Wrenches ECO, for semi-professional use, 10 - 350 N·m, with calibration certificate	click	± 4%	DIN EN ISO 6789	10	- 110	10,0	3/8
6172 0020							28	- 210	12,5	1/2
6172 0030							50	- 350	12,5	1/2
6174 0010		6174	Torque Wrenches MULTITOUCH, with close gap release, 5 - 2000 N·m, allows tightening from every position	click	± 4%	DIN EN ISO 6789	5	- 33	10,0	3/8
6174 0030							25	- 150	12,5	1/2
6174 0040							50	- 250	12,5	1/2
6174 0050							70	- 350	12,5	1/2
6174 0060							140	- 800	20,0	3/4
6174 0070							200	- 1000	25,0	1
6174 0080							500	- 2000	25,0	1
6175 0025		6175	Torque Wrenches UNO, for industry and automotive, 5 - 1.000 N·m, extremely precise and easy to use.	click	± 3%	DIN EN ISO 6789	1	- 25	6,3	1/4
6175 0050							5	- 50	10,0	3/8
6175 0100							10	- 100	12,5	1/2
6175 0200							20	- 200	12,5	1/2
6175 0340							56	- 340	12,5	1/2
6175 0550							102	- 550	20,0	3/4
6175 0750							140	- 750	20,0	3/4
6175 1000							190	- 1000	25,0	1
6175 5050		6175	Torque Wrenches UNO, for insert tools, 5 - 340 N·m, extremely precise and easy to use.	click	± 3%	DIN EN ISO 6789	5	- 50	9x12	6,3 (1/4)
6175 5100							10	- 100	9x12	6,3 (1/4)
6175 5200							20	- 200	14x18	12,5 (1/2)
6175 5340							56	- 340	14x18	12,5 (1/2)

Art. Code	Model	Art. Grp.	Short description	Type	Tolerance	Standard	Measuring range in N·m		mm	mm (")
6179 0025		6179	Torque Wrenches VDE, 5 - 220 N·m.	click	± 4%	DIN EN ISO 6789	5	- 25	10,0	3/8
6179 0100							20	- 100	12,5	1/2
6179 0200							44	- 220	12,5	1/2

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MATADOR service.
Factory calibration and more in our own laboratory.
Traceable to national standards.

i

What are national standards?

The highest reference level for the calibration of torque tools is the national standard. This standard is the most precise measuring tool used to calibrate other measuring tools.

A national standard is the legally binding basis for a respective physical parameter. In accordance with the international definition this standard represents the lowest possible measurement inaccuracy based on the latest technology.

There is a calibration hierarchy of standards within which the measurement accuracy decreases from level to level. This structure makes it possible to compare test results worldwide and to guarantee trace-ability to a national standard. In certified companies measuring equipment must be traceable to national standards and has to be re-calibrated regularly. This monitoring of measuring devices is a means of quality assurance and ensures uniform and reliable high-quality measuring results.

The MATADOR factory calibration.

All MATADOR torque wrenches are produced to the highest quality standards, adjusted, traceably calibrated and certified. Each tool comes with a factory calibration certificate.

If requested MATADOR torque wrenches are recalibrated within 5-7 workdays at a reasonable price. Also, the tools can be repaired in-house at any time.

DAkkS certificate on request.

For a 100% documentation MATADOR can also provide a calibration certificate according to DAkkS standards in cooperation with an accredited laboratory. Calibration is then directly trace-able to the national standard and reaches the highest level of accuracy.
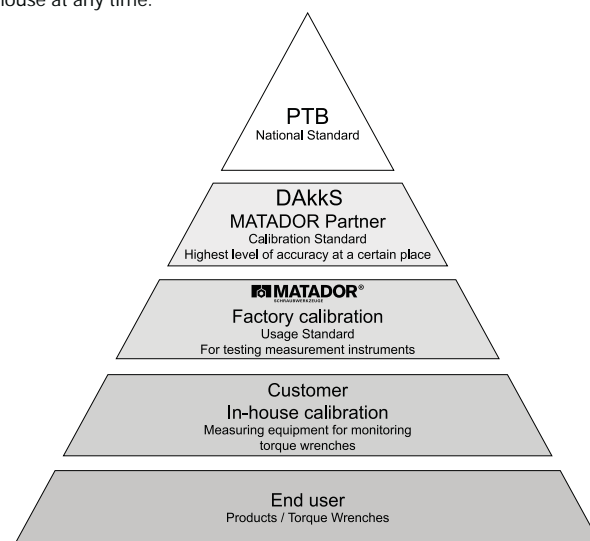
Please feel free to contact us.

What is made during recalibration?

Torque tools are measuring instruments and are subject to natural wear. We thus recommend to have torque wrenches recalibrated at regular intervals (generally once a year) or at least after 5000 load cycles to guarantee long-term precision.

During recalibration in our in-house laboratory the torque wrenches are checked for their proper function and then - according to DIN EN ISO 6789 - tested at 20%, 60% and 100% of the maximum torque.

At any test point 5 measurements are made and documented. If the measured values are within the tolerance a factory calibration certificate is issued. If the measured values do not meet the requested tolerance the torque wrench is adjusted and the test procedure is repeated.

PTB
National Standard

DAkkS
MATADOR Partner
Calibration Standard
Highest level of accuracy at a certain place

MATADOR ®
Factory calibration
Usage Standard
For testing measurement instruments

Customer
In-house calibration
Measuring equipment for monitoring torque wrenches

End user
Products / Torque Wrenches

MATADOR Torque Screwdriver.
Little effort - big effect.
Controlled screw tightening in confined spaces.

According to DIN EN ISO 6789 with individual serial number and including calibration certificate.

Safe adjustment of the set value.

Ergonomic handle.

Clearly readable scale in N·m.

With bit holder in 6.3 mm (1/4"), together with square adapter also usable for hexagon sockets.
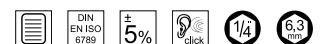
▪ Torque Screwdrivers

– For controlled tightening of screws from 0.1 - 6 N·m

– Manually adjustable to individual target values

– Easily readable micrometer scale

– Accuracy ±5% tolerance from set scale value

– Precise reading accuracy for a minimum of 5,000 tightening cycles

– For controlled tightening in clockwise and anti-clockwise direction

– Clearly palpable and audible torque release

– Ergonomic design of the handle for safe torque transmission

– With square drive for bits according to DIN 3126

- C 6.3, together with adapter also usable for sockets with square drive according to DIN 3124 C 6.3 (not included, art. code 2084 0002)

– With individual serial number for clear product identification

– Including calibration certificate according to DIN EN ISO 6789
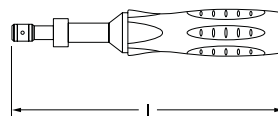
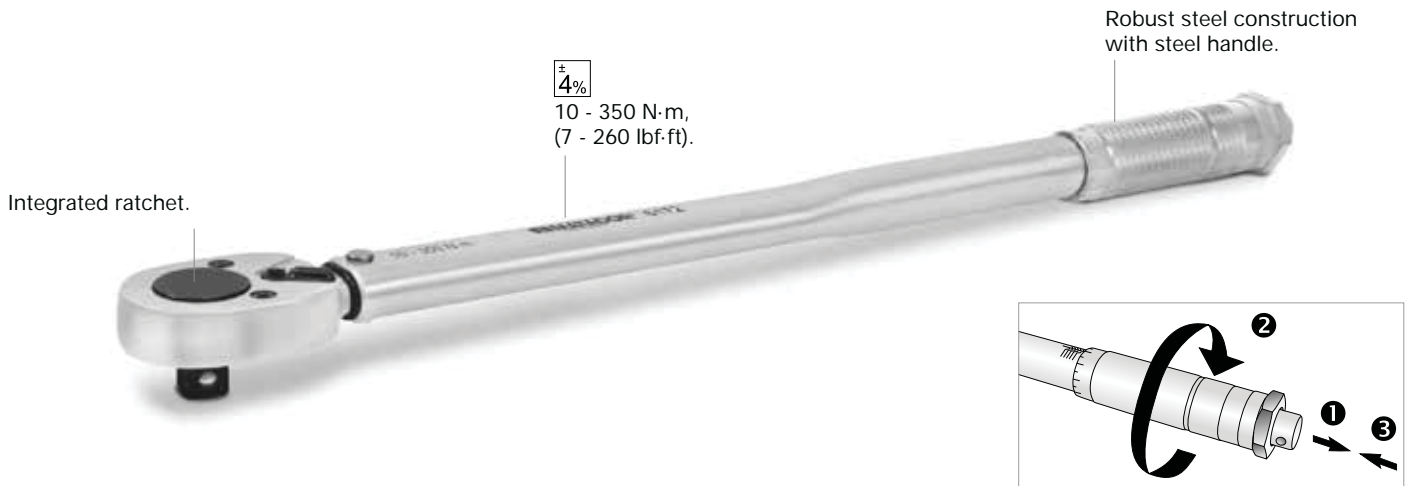| Art. Code	mm	"	cN·m	N·m	cN·m	N·m	l mm	g	
6170 0010	6,3	1/4	10-120	0,1-1,2	1,0	--	180	207	1
6170 0020	6,3	1/4	--	1-6		0,1	248	475	1

MATADOR®
SCHRAUBWERKZEUGE

MATADOR Torque Wrenches ECO.
Save your budget.
For semi-professional use.

Robust steel construction with steel handle.

±4%

10 - 350 N·m,
(7 - 260 lbf·ft).

Integrated ratchet.

■ Torque Wrenches ECO

DIN EN ISO 6789   ±4%   click
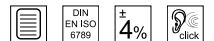
– Click type torque wrenches for semi-professional use

– Accuracy ±4% tolerance from the set scale value

– Precise reading accuracy for a minimum of 5000 tightening cycles

– For controlled clockwise and anti-clockwise tightening (thus not for untightening)

– With knurled steel handle for easy adjustment of the desired torque value

– Durable double scale thanks to stamping in N·m and m·kgs with fine adjustment

– Clearly audible release

– With square drive according to DIN 3120 - ISO 1174 with ball stop and integrated lever reversible ratchet

– With individual serial number and calibration certificate according to DIN EN ISO 6789

– In attractive DIY packaging
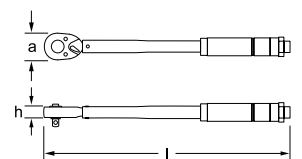
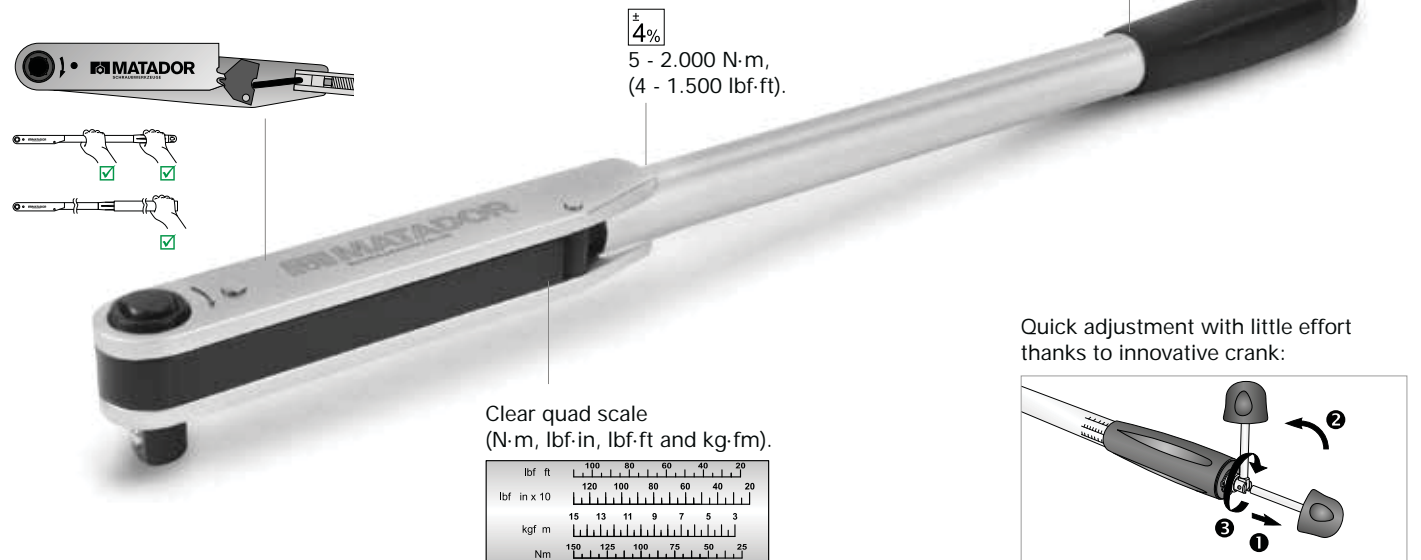| Art. Code	mm	"	N·m	m·kgs	N·m	m·kgs	a mm	h mm	l mm	g	
6172 0010	10,0	3/8	10 - 110	1 - 11	1	0,1	37,0	15,0	370	600	1
6172 0020	12,5	1/2	28 - 210	3 - 21	1	0,1	46,0	17,5	470	800	1
6172 0030	12,5	1/2	50 - 350	5 - 35	1	0,1	41,0	20,5	630	1000	1

MATADOR Torque Wrenches MULTITOUCH.
No offsets, no matter where you touch.
## Absolutely error-free operation thanks to single lever mechanism.

Tightening from every position due to uniaxial position of pivot and square drive.

Ergonomic handle with protected adjustment mechanism.

±4%
5 - 2.000 N·m,
(4 - 1.500 lbf·ft).

Clear quad scale
(N·m, lbf·in, lbf·ft and kg·fm).

	100	80	60	40	20
lbf ft					
lbf in x 10	120	100	80	60	40	20
kgf m	15	13	11	9	7	5	3
Nm	150	125	100	75	50	25

Quick adjustment with little effort thanks to innovative crank:

## ■ Torque Wrenches MULTITOUCH

DIN EN ISO 6789   ±4%   click

– Click type torque wrench

– Accuracy ±4% tolerance of the set scale value

– For continuous heavy duty operation at construction sites, in workshops and industry

– Especially simple operation and long durability thanks to single lever mechanism

– Precise reading accuracy for a minimum of 5000 tightening cycles

– For controlled clockwise and anti-clockwise tightening

– Permanently readable quad scale

– Clearly audible and palpable release

– With push-through square according to DIN 3120 - ISO 1174 with ball stop

– With individual serial number and calibration certificate according to DIN EN ISO 6789
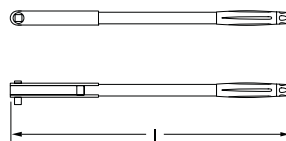
Art. Code	mm	"	N·m	lbf·ft	lbf·in	kgf·m	N·m	l mm	g	
6174 0010	10,0	3/8	5 - 33	4 - 24	40 - 300	0,5 - 3,4	0,5	405	690	1
6174 0030	12,5	1/2	25 - 150	20 - 110	200 - 1300	2,5 - 15	2	575	1700	1
6174 0040	12,5	1/2	50 - 250	40 - 180	450 - 2200	5 - 25	5	605	2300	1
6174 0050	12,5	1/2	70 - 350	50 - 260	500 - 3100	7 - 35	10	815	3000	1
6174 0060	20,0	3/4	140 - 800	120 - 580	1400 - 7000	14 - 80	20	815	6500	1
6174 0070	25,0	1	200 - 1000	150 - 750	1500 - 8500	20 - 100	25	1030	9700	1
6174 0080	25,0	1	500 - 2000	350 - 1500	4500 - 17500	50 - 200	50	1400	18000	1

– Spare squares:

Art. Code	mm	"	g	
6174 0910	10,0	3/8	50	1
6174 0930	12,5	1/2	70	1
6174 0960	20,0	3/4	90	1
6174 0980	25,0	1	120	1
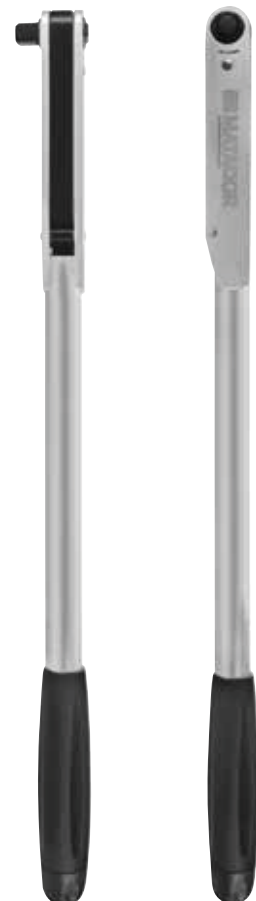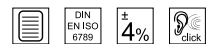
Torque wrenches UNO.
One window. One value. One grip. One click.

48 | click | DIN EN ISO 6789 | ± 3%

| Art. Code	mm / "		N·m		g	
6175 0010	6,3 mm	1/4	1 - 25	Repair Kit UNO	--	1
6175 0011	10 mm	3/8	5 - 50	Repair Kit UNO	--	1
6175 0012	12,5 mm	1/2	10 - 100	Repair Kit UNO	--	1
6175 0013	12,5 mm	1/2	20 - 200	Repair Kit UNO	--	1
6175 0016	12,5 mm	1/2	56 - 340	Repair Kit UNO	--	1
6175 0014	20 mm	3/4	102 - 550	Repair Kit UNO	--	1
6175 0015	25 mm	1	190 - 1000	Repair Kit UNO	--	1

Make complicated things simple.

Easy setting at the end of the handle.

Only one window with clear numeric value in N·m.
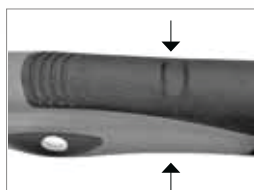
Error-free handling thanks to double-sided finger grooves.

Integrated lever ratchet with small head to reach tiny areas.

Well protected in solid plastic case.

Extremely precise and easy to use.

The new professional torque wrench by MATADOR with **an absolutety innovative operating concept**:

Easy setting with extra fine graduation (from 0.5 N·m to 1.0 N·m on larger models), **only one window with clear numeric value in N·m**. No division scale which is difficult to read.

With small ratchet head to reach tiny spaces, with lever and 48 teeth, safety lock and quick-release function. Permanent protection of the body thanks to full powder coating.

The handy and ergonomically optimal design of the handle with its integrated finger grooves make the correct use a breeze. Clearly audible and perceptible signal when the desired torque value is reached.

The MATADOR UNO is extremely precise: **maximum deviation only ±3%** from the set scale value. For controlled clockwise operation. With German calibration certificate according to DIN EN ISO 6789.
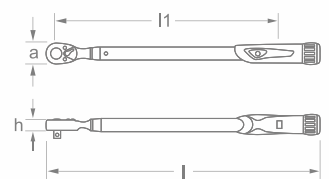
From 5 - 1,000 N·m.
For industry and automotive.

Art. Code	mm / "		N·m	l1 mm	a mm	h mm	l mm	g	
6175 0025	6,3 mm	¼	1 - 25	250	22.5	19.6	343	760	1
6175 0050	10 mm	⅜	5 - 50	322	31.2	26.7	419	983	1
6175 0100	12,5 mm	½	10 - 100	337	41.0	36.4	440	998	1
6175 0200	12,5 mm	½	20 - 200	435	41.0	36.4	540	1360	1
6175 0340	12,5 mm	½	56 - 340	538	41.0	36.4	640	1730	1
6175 0550	20 mm	¾	102 - 550	827	58.0	55.0	938	4500	1
6175 0750	20 mm	¾	140 - 750	1107	58.0	55.0	1218	5850	1
6175 1000	25 mm	1	190 - 1000	1393	67.0	67.0	1508	7426	1
6175 5050	9x12 mm		5 - 50	322	31.2	26.7	378	886	1
6175 5100	9x12 mm		10 - 100	322	31,2	26,7	378	886	1
6175 5200	14x18 mm		20 - 200	435	41.0	36.4	490	1180	1
6175 5340	14x18 mm		56 - 340	538	41.0	36.4	595	1554	1

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SCHRAUBWERKZEUGE
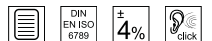
Torque Wrenches VDE.
Safety first.

1000 V

■ Torque Wrenches VDE

- Click type torque wrench with reversible ratchet head
- Accuracy ±4% tolerance from the set scale value
- Precise reading accuracy for a minimum of 5000 tightening cycles
- For controlled clockwise and anti-clockwise tightening
- Clearly palpable and audible torque release

- Double scale in N·m and lbf·ft
- Robust ratchet mechanism
- Large vision panel with magnifiers for optimal readability of the set values
- Ergonomic and hand-friendly handle
- Safety lock at the end of the handle
- With square drive according to DIN 3120 - ISO 1174 with ball stop
- With individual serial number and test certificate according to DIN EN ISO 6789

DIN EN ISO 6789 ±4%

MATADOR
Double
Check
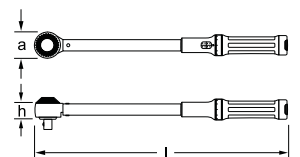
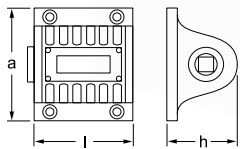| Art. Code	mm	"	N·m	lbf·ft	N·m	a mm	h mm	l mm	g	
6179 0025	10,0	3/8	5 - 25	4 - 20	0,25	35	18	289	410	10
6179 0100	12,5	1/2	20 - 100	15 - 74	0,50	45	23	350	1378	10
6179 0200	12,5	1/2	44 - 220	32 - 162	0,50	45	23	412	1500	10

MATADOR Torque Testers.
Turn on, test, ready.
Very simple and cost effective.

±1%

10 - 2000 N·m,
(7,4 - 1475 lbf·ft).

With inner square drive
12.5 mm (1/2").

For click type, dial and digital
torque wrenches:
Model 6180 Plus.

With 27 mm male hexagon, supplied
with 20 mm (3/4") or 25 mm (1")
square drive socket.

▪ Torque Testers

– For easy testing and calibration of click type
torque wrenches

– Simple operation, only one button to zero
the display

– Large 4-digit LCD-Display

– With automatic switch-off

– Inner square according to DIN 3120 / ISO 1174
with ball stop

– Measurement in N·m

– Delivered in solid black plastic case with
power cable

– With traceable calibration certificate for
clockwise direction according to
DIN EN ISO 6789

Model 6180 Plus for click type, dial and
digital torque wrenches

– Additionally equipped with

– Display for three torque units: N·m, lbf·ft
and lbf·in

– Three operation modes: track mode for
continuous monitoring of torque signal,
1st peak mode or final peak mode

– Limit feature: the operator sets target torque and
tolerance and instrument calculates whether the
reading is within tolerance and indicates the re-
sult by illuminating one of three coloured LEDs)

– Delivered with RS-232 lead

– Software separately available

DIN EN ISO 6789   ±1%
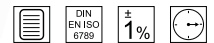
Art. Code	mm	"	mm	N·m	lbf·ft	a mm	h mm	l mm	g	
6180 0001	12,5	1/2		10 - 350	7,4 - 258	145,5	85,0	150,0	3200	1
6180 0002	20,0	3/4	27 mm	100 - 1000	74 - 737	145,5	85,0	175,0	4800	1
6180 0003	25,0	1	27 mm	200 - 2000	147 - 1475	145,5	85,0	175,0	5600	1

Model 6180 Plus:

Art. Code	mm	"	mm	N·m	lbf·ft	a mm	h mm	l mm	g	
6180 0011	12,5	1/2		10 - 350	7,4 - 258	145,5	85,0	150,0	3200	1
6180 0012	20,0	3/4	27 mm	100 - 1000	74 - 737	145,5	85,0	175,0	4800	1
6180 0013	25,0	1	27 mm	200 - 2000	147 - 1475	145,5	85,0	175,0	5600	1

Insert tools for rectangular tool holders.
Directly from certified manufacturer.

With depth gauges (s_k) for
9 x 12 mm = 17.5 mm, for
14 x 18 mm = 25 mm, other
values are marked with *).

For rectangular cavities si-
zed 9 x 12 or 14 x 18 mm.

Customized insert tools.

MATADOR is first-level supplier of
insert tools for numerous leading
automobile manufacturers. Also
special, extra flat insert ratchets wi-
th lever are part of our range.

We would be pleased to submit an
individual offer to you based on your
special requirements - either as hot
formed forging parts, as cast parts
or cut on modern CNC machines
from solid material.

Please do not hesitate to contact us.

When do you have to calculate?

The calibration of a torque wrench is
based on a fixed fulcrum (usually at
the same level as the square drive).
If the measure of length changes
the original lever is no longer valid
and the set torque value (MxW) has
to be adjusted by a correction factor.

The correct length is the crucial factor.

Especially when using insert tools
the given depth gauge is to be
considered. If the depth gauge of
the torque wrench (s_k) is equal to
the depth gauge of the insert tool (s)
the indicated value corresponds to
the value of the applied force.

Correction of the torque value.

Insert tools with different depth gau-
ges (s) are marked with a * in the re-
spective table.

In these cases and also when using
adapters the desired tightening tor-
que (MA) has to be corrected
by the linear factor with the help
of the following formula:

Example:
Correction of the set torque value:
Desired tightening torque M_A = 180 N·m:

$$\frac{180 \cdot 435}{435 + (32,5 - 25)} = \frac{78.300}{442,5} = 176,95 \text{ N·m}$$

$$M_{xW} = \frac{M_A \times l_k}{l_k + (s - s_k)}$$

l_k s_k s

Art.-Nm.	mm	N·m	N·m	N·m	L mm	L, mm	S mm	l mm
6185 0001	9 x 12	5 - 50	5 - 17	0,25	295	17,5	335	450
6185 0002	9 x 12	10 - 100	6 - 70	0,50			375	
6185 0003	14 x 18	20 - 200	15 - 118	1,00	435	25,0	470	880
6185 0004	14 x 18	40 - 400	45 - 236	1,80			565	1200
6185 0005	14 x 18	100 - 550	70 - 435	1,80	675	25,0	920	3750
6185 0006	14 x 18	200 - 750	140 - 553	1,80	1195	25,0	1120	5270

Art.-Nm.	mm	N·m	N·m	L mm	L, mm	S mm	l mm	g
6190 0210	14 x 18	21	25,6	50	11	160	1
6190 0220	14 x 18	22	25,6	50	11	163	1
6190 0240	14 x 18	24	25,6	52	12	165	1
6190 0260	14 x 18	26		60	13	188	1
6190 0270	14 x 18	27	37,5*	60	13	240	1
6190 0300	14 x 18	30		60	14	250	1
6190 0320	14 x 18	32	37,5*	66	14	250	1

■ Insert Reversible Ratchets

– With pin lock

– Fine-toothed

– Max. load of coupler 9 x 12:
6.3 (1/4) = 30 N·m, 10 (3/8) = 135 N·m,
12,5 (1/2) = 150 N·m

– Max. load of coupler 14 x 18:
12.5 (1/2) = 340 N·m, 20 (3/4) = 400 N·m

– Material: Chrome-Vanadium

– Surface: Matt chrome finish
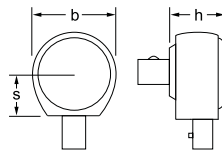
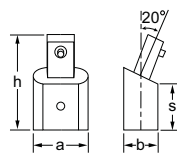| Art. Code	mm	mm	"	s mm	b mm	h mm	g	
6186 0001	9 x 12	6,3	1/4	17,5	27	25	75	1
6186 0002	9 x 12	10,0	3/8	17,5	35	35	152	1
6186 0003	9 x 12	12,5	1/2	17,5	43	40	228	1
6186 0004	14 x 18	12,5	1/2	25,0	43	43	260	1
6186 0005	14 x 18	20,0	3/4	25,0	70	60	795	1

■ Insert Weld-On Fittings

– With pin lock

– For welding special tools

– Welding surface 8 x 14 mm (9 x 12)
and 11 x 25 mm (14 x 18)

– *) = please consider the depth gauge (s) for
correct calculation of the torque value
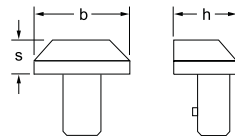
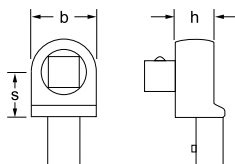| Art. Code	mm	s mm	b mm	h mm	g	
6187 0001	9 x 12	8*	14	14,5	47	1
6187 0002	14 x 18	12*	25	21,5	100	1

■ Insert Adapter

– Adapter for confined areas

– With 20° angle

– With pin lock

– *) = please consider the depth gauge (s) for
correct calculation of the torque value

Art. Code	mm	mm	s mm	b mm	h mm	a mm	g	
6187 0004	9 x 12	9 x 12	20*	17	40	22	47	1

■ Insert Square Heads

– Max. load of coupler 9 x 12:
6.3 (1/4) = 30 N·m, 10 (3/8) = 135 N·m,
12.5 (1/2) = 150 N·m

– Max. load of coupler 14 x 18:
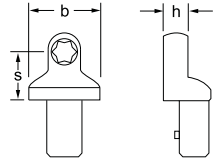12.5 (1/2) = 340 N·m, 20 (3/4) = 400 N·m

Art. Code	mm	mm	"	s mm	b mm	h mm	g	
6188 0001	9 x 12	6,3	1/4	17,5	20	14	70	1
6188 0002	9 x 12	10,0	3/8	17,5	20	14	76	1
6188 0003	9 x 12	12,5	1/2	17,5	20	14	80	1
6188 0004	14 x 18	12,5	1/2	25,0	27	18	210	1
6188 0005	14 x 18	20,0	3/4	25,0	40	25	400	1

MATADOR®
SCHRAUBWERKZEUGE

■ Insert Bit Holders

- For inserting bits
- With pin lock
- Material: Chrome-Vanadium
- Surface: Matt chrome plated

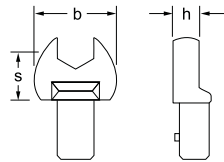| Art. Code	mm	mm	"	s mm	b mm	h mm	g	
6189 0001	9 x 12	6,3	1/4	17,5	14	10,0	47	1
6189 0002	9 x 12	8,0	5/16	17,5	16	12,5	47	1
6189 0003	14 x 18	8,0	5/16	25,0	16	12,5	115	1

■ Open End Insert Tools

- With pin lock
- *) = please consider the depth gauge (s) for correct calculation of the torque value
- Material: Chrome-Vanadium
- Surface: Matt chrome plated

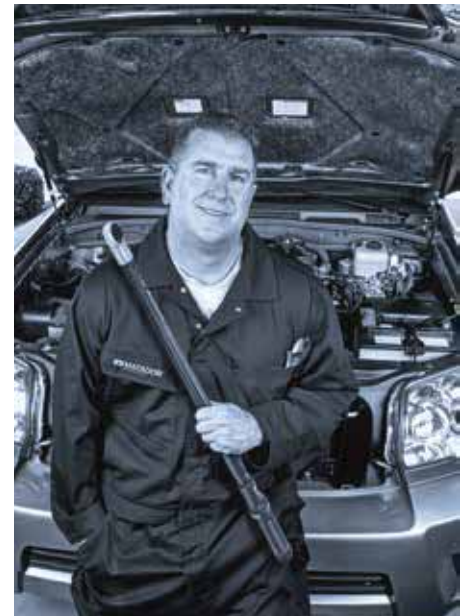| Art. Code	mm	mm	s mm	b mm	h mm	g	
6190 0070	9 x 12	7	17,5	22	5,0	37	1
6190 0080	9 x 12	8	17,5	22	5,0	38	1
6190 0090	9 x 12	9	17,5	26	5,5	37	1
6190 0100	9 x 12	10	17,5	26	5,5	42	1
6190 0110	9 x 12	11	17,5	26	5,5	40	1
6190 0120	9 x 12	12	17,5	30	7,0	41	1
6190 0130	9 x 12	13	17,5	30	7,0	46	1
6190 0140	9 x 12	14	20,0*	35	8,0	55	1
6190 0150	9 x 12	15	20,0*	35	8,0	55	1
6190 0160	9 x 12	16	20,0*	38	8,5	58	1
6190 0170	9 x 12	17	20,0*	38	8,5	58	1
6190 0180	9 x 12	18	20,0*	42	9,0	60	1
6190 0190	9 x 12	19	20,0*	42	9,0	64	1
6190 1130	14 x 18	13	25,0	30	7,0	118	1
6190 1140	14 x 18	14	25,0	35	8,0	120	1
6190 1150	14 x 18	15	25,0	35	8,0	116	1
6190 1160	14 x 18	16	25,0	38	9,0	128	1
6190 1170	14 x 18	17	25,0	38	9,0	138	1
6190 1180	14 x 18	18	25,0	42	10,0	136	1
6190 1190	14 x 18	19	25,0	42	10,0	140	1
6190 1210	14 x 18	21	25,0	50	11,0	160	1
6190 1220	14 x 18	22	25,0	50	11,0	163	1
6190 1240	14 x 18	24	25,0	53	12,0	165	1
6190 1260	14 x 18	26	25,0	60	13,0	168	1
6190 1270	14 x 18	27	32,5*	60	13,0	240	1
6190 1300	14 x 18	30	32,5*	66	14,0	250	1
6190 1320	14 x 18	32	32,5*	66	14,0	250	1
6190 1340	14 x 18	34	32,5*	66	14,0	253	1
6190 1360	14 x 18	36	32,5*	74	15,0	245	1
6190 1380	14 x 18	38	32,5*	74	15,0	230	1
6190 1400	14 x 18	40	40,0*	82	15,0	315	1
6190 1410	14 x 18	41	40,0*	82	15,0	316	1

■ Ring End Insert Tools

– With pin lock

– *) = please consider the depth gauge (s) for
correct calculation of the torque value
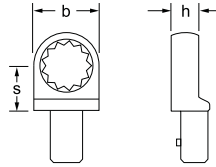
Art. Code	mm	mm	s mm	b mm	h mm	g	
6191 0070	9 x 12	7	17,5	13,0	8	38	1
6191 0080	9 x 12	8	17,5	14,2	8	37	1
6191 0100	9 x 12	10	17,5	17,2	9	40	1
6191 0110	9 x 12	11	17,5	18,5	9	42	1
6191 0120	9 x 12	12	17,5	20,0	12	51	1
6191 0130	9 x 12	13	17,5	21,5	12	51	1
6191 0140	9 x 12	14	17,5	23,0	12	53	1
6191 0160	9 x 12	16	17,5	25,7	13	56	1
6191 0170	9 x 12	17	17,5	27,2	13	55	1
6191 0180	9 x 12	18	17,5	28,5	13	60	1
6191 0190	9 x 12	19	17,5	30,3	13	64	1
6191 0210	9 x 12	21	17,5	33,0	15	68	1
6191 0220	9 x 12	22	17,5	34,5	15	71	1
6191 1130	14 x 18	13	25,0	21,5	11	130	1
6191 1140	14 x 18	14	25,0	23,0	11	132	1
6191 1160	14 x 18	16	25,0	25,7	12	137	1
6191 1170	14 x 18	17	25,0	27,2	12	141	1
6191 1180	14 x 18	18	25,0	28,5	12	139	1
6191 1190	14 x 18	19	25,0	30,5	12	145	1
6191 1210	14 x 18	21	25,0	33,0	15	152	1
6191 1220	14 x 18	22	25,0	34,5	15	157	1
6191 1240	14 x 18	24	25,0	37,5	15	162	1
6191 1270	14 x 18	27	31,0*	41,5	17	205	1
6191 1300	14 x 18	30	31,0*	45,0	19	205	1
6191 1320	14 x 18	32	31,0*	47,5	19	214	1
6191 1340	14 x 18	34	31,0*	50,5	19	226	1
6191 1360	14 x 18	36	31,0*	53,0	19	230	1
6191 1380	14 x 18	38	31,0*	53,0	19	230	1
6191 1410	14 x 18	41	31,0*	59,0	20	235	1

■ Flared Ring End Insert Tools

– With pin lock

– *) = please consider the depth gauge (s) for
correct calculation of the torque value
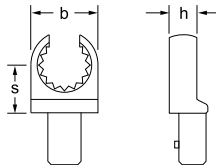
Art. Code	mm	mm	s mm	b mm	h mm	g	
6192 0100	9 x 12	10	17,5	21,0	11,0	40	1
6192 0110	9 x 12	11	17,5	22,5	11,0	40	1
6192 0120	9 x 12	12	17,5	23,7	11,0	40	1
6192 0130	9 x 12	13	17,5	25,2	11,0	40	1
6192 0140	9 x 12	14	17,5	27,0	12,0	50	1
6192 0170	9 x 12	17	17,5	31,5	12,0	65	1
6192 0180	9 x 12	18	17,5	33,0	14,5	65	1
6192 0190	9 x 12	19	17,5	34,5	14,5	65	1
6192 0220	9 x 12	22	20,0*	39,0	14,5	65	1

Assortments of Insert Tools.
All important insert tools in a solid metal case.

MTS — MATADOR TOOL SYSTEM.

5 - 50 or 10 - 100 N·m.

In robust metal case.

72

■ Sets of Open End Insert Tools 9 x 12

MTS MATADOR TOOL SYSTEM.

– Sets with the most important open end insert tools with rectangular cavity in 9 x 12 mm

– With torque wrench and fine teeth insert reversible ratchet

Art. Code			l mm	b mm	g	
6190 9100	10	5 - 50 N·m	445	185	1400	1
6190 9101	10	10 - 100 N·m	445	185	1400	1
	9x12 mm	6185				
	12.5 mm 1/2	6186				
		6190 8 - 10 - 11 - 12 - 13 - 16 - 17 - 19 mm				

■ Sets of Ring End Insert Tools 9 x 12

MTS MATADOR TOOL SYSTEM.

– Sets with the most important ring end insert tools with rectangular cavity in 9 x 12 mm

– With torque wrench and fine teeth insert reversible ratchet

Art. Code			l mm	b mm	g	
6191 9100	10	5 - 50 N·m	445	185	1400	1
6191 9101	10	10 - 100 N·m	445	185	1400	1
	9x12 mm	6185				
	12.5 mm 1/2	6186				
		6191 8 - 10 - 11 - 12 - 13 - 16 - 17 - 19 mm				

■ Set of Insert Tools Basic 9 x 12

– Set with the most important open and ring end insert tools with rectangular cavity in 9 x 12 mm

– Without torque wrench

– With fine teeth insert reversible ratchet

MATADOR TOOL SYSTEM.

Art. Code		l mm	b mm	g	
6194 9170 17		445	185	1400	1
	6186 12.5 1/2				
	6190 8 - 10 - 11 - 12 - 13 - 16 - 17 - 19 mm				
	6191 8 - 10 - 11 - 12 - 13 - 16 - 17 - 19 mm				

■ Sets of Insert Tools Pro 9 x 12

– Set with the most important insert tools with rectangular cavity in 9 x 12 mm

– With torque wrench

– With fine teeth insert reversible ratchet

MATADOR TOOL SYSTEM.

Art. Code		l mm	b mm	g	
6194 9180 18	5 - 50 N·m	445	185	1350	1
6194 9181 18	10 - 100 N·m	445	185	1400	1
	6185 9x12 mm				
	6186 12.5 1/2				
	6190 8 - 10 - 11 - 12 - 13 - 16 - 17 - 19 mm				
	6191 8 - 10 - 11 - 12 - 13 - 16 - 17 - 19 mm				

■ Set of Open End Insert Tools 14 x 18

– Set with the most important open end insert tools with rectangular cavity in 14 x 18 mm

– With fine teeth insert reversible ratchet

MATADOR TOOL SYSTEM.

Art. Code		l mm	b mm	g	
6190 9110 11		445	185	1300	1
	6186 12.5 1/2				
	6190 13 - 16 - 17 - 19 - 21 - 22 - 24 - 27 - 30 - 32 mm				

■ Set of Ring End Insert Tools 14 x 18

– Set with the most important ring end insert tools with rectangular cavity in 14 x 18 mm

– With fine teeth insert reversible ratchet

MATADOR TOOL SYSTEM.

Art. Code		l mm	b mm	g	
6191 9110 11		445	185	1300	1
	6186 12.5 1/2				
	6191 13 - 16 - 17 - 19 - 21 - 22 - 24 - 27 - 30 - 32 mm				

High Output Torque = Low Input Torque x Revolution.

The function principle of a torque multiplier.

Why use a torque multiplier?

The longer a lever arm the higher the force action. But espacially when it comes to industrial screw connections from a certain torque value onwards this basic physical principle is no longer practicable. In case of high torque values it is even no longer possible. For instance, a torque value of 9500 N·m / 7000 lbf· ft cannot be reached with a torque wrench in accordance with the lever rule which says that the distance to the fulcrum determines the rotational effect of the applied force.

Torque multipliers provide a remedy. They substitute the classic lever principle by the physical formula:

Torque (Output) =
Torque (Input) x Revolution.

It is thus the number of revolutions that determines the output torque, not the lenght of the lever.

Effective gearing as a standard.

Torque multipliers can be compared to adapters which multiply the applied force (= the input torque) with the help of a gear without having to use long lever arms. The multiplying effect depends on the gear ratio of the gear used.

MATADOR torque multipliers are equipped with high quality ball-bearing precision planetary gears that have an additional overload protection. Thanks to the effective gear ratio the desired output torque is easy to calculate and complicated correction tables are things of the past.

Torque multipliers are very robust and designed for continuous operation under industrial conditions. They should not be missing in any workshop.

Maximum power in the smallest of spaces.

Torque Multipliers are ideal for mobile application thanks to usage without any electronic or pneumatic support.

The main benefits are:

☑ Very high power application without long lever arms, use-able in most confined spaces

☑ Work with standard workshop torque wrenches, no hidden extra costs

☑ Effective gearing, specified gear ratio is the true factor for torque multiplication

☑ Lower priced and more variable in use than comparable torque wrenches

☑ From 4 500 N·m / 3 300 lbf·ft with anti-wind-up ratchet for safe working

Function example

Input torque
= 300 N·m / 220 lbf·ft

Gear ratio 1:5

Output torque
= 1500 N·m / 1100 lbf·ft

Based on a gear ratio of 1:5, 5 revolutions at the input (with an input torque of 300 N·m / 220 lbf·ft) are required in order to achieve 1500 N·m / 1100 lbf·ft as the output torque.
Input torque and output torque are regarded as constant, the power is only determined by the number of revolutions.
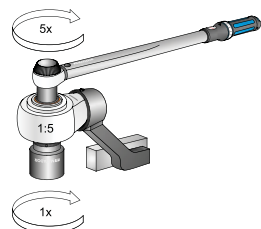
MATADOR Torque Multipliers.
The solid compact class.
More power without long levers.

Heavy duty construction with planet gear mechanism with 3 precisely engineered gear stages and hardened gear wheels.

With reaction arm.

1.500 – 2.700 N·m
(1100 - 2,000 lbf·ft).

Including plug-in reaction foot

In solid plastic case

■ Torque Multipliers

– Perfect for applications where compact size and weight are critical or for mobile use

– For reducing the effort of applying high torque without electric or pneumatic devices

– Planet gear mechanism with 3 precisely engineered gear stages

– True 5:1 torque multiplication

– Multiplication accuracy according to DIN ISO 6789 / ASME B107.14M-1994 better than ±5%

– Supplied with 2 reaction styles for maximum versatility (reaction bar and plug-in reaction foot)

– In extremely sturdy plastic case

±5%

□ 12,5 (1/2)

21
23,25
46,7
126
36,25

Ø108
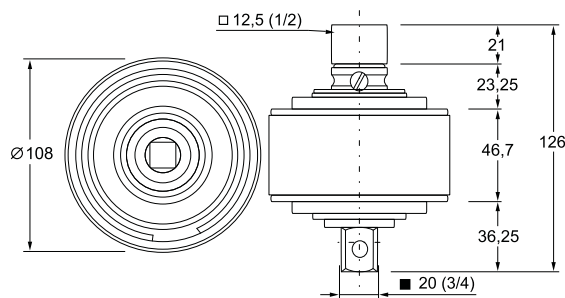
■ 20 (3/4)

Art. Code	mm	"	mm	"	N·m	lbf·ft		N·m	lbf·ft	mm	g	g	
6182 0010	20	3/4	12,5	1/2	1500	1100	1:5	300	220	108	3500	6480	1
6182 0020	25	1	12,5	1/2	2700	2000	1:5	540	400	108	4150	6480	1