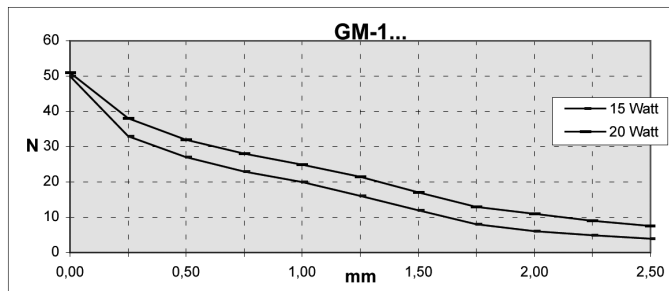


## Type GM-1

PUSH AND PULL  
EXT. DIA. OF TUBE 10 MM

3010  
ELECTROMAGNETIC SOLENOIDS

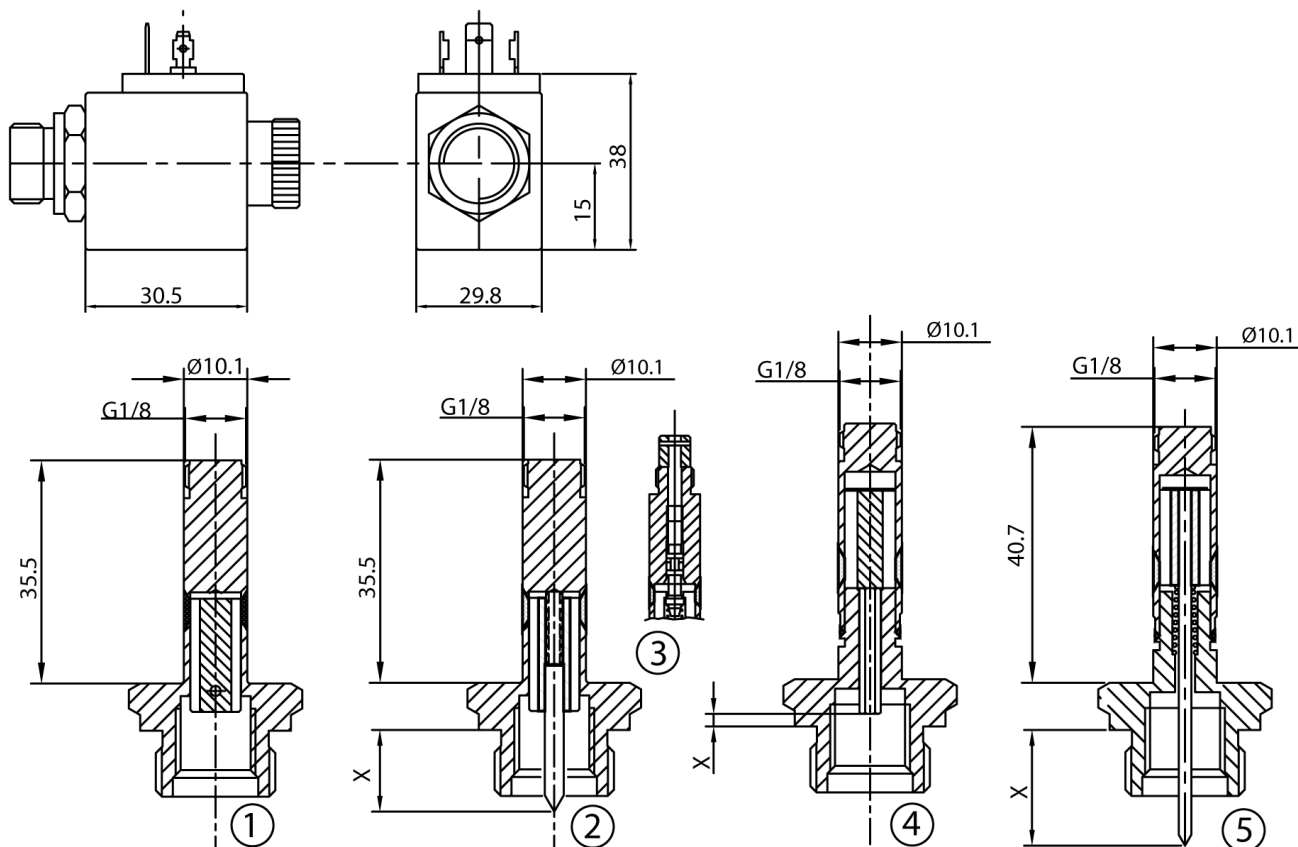
CHARACTERISTICS OF STANDARDIZED EXECUTIONS		
- other executions are available on request		
operation: pulling on/off-code GM-13..., pushing on/off-code GM-10..		
stroke: on request	push rod options : see below	
manual override: available for pulling version		
standardised threads (interface to the valve) -other variants: on request	external	internal
	3/4"-16UNF	1/2"-20UNF
	3/4"-16UNF	M13x1
	M 18x1,5	M13x1
max dynamic pressure: up to 350 bar		
curves of force-stroke: diagrams refer to supply 0,66 Vnom. and stroke back from end stop. Note: curves can be modified according to operating characteristics requested by the valve.		



STANDARD COILS - ED 100% - see table 5010				
- other voltages, electric powers, insulation class, ED : on request				
code of (1) coil	electric connection	supply voltage - V (+/- 10%) available for all executions	nominal power (3)	insulation class
C28D***	DIN43650	DC: 12; 24 & 21,6 ;98;196 (2)	15 or 20 W	F, H respect.
C28C***	flying leads			
C28F***	faston			
(1) *** code must be completed by voltage supply and requested power				
(2) voltages normally provided for AC supply at 24, 110, 220 with rectifier				
(3) holding value at cold coil				
ambient temperature: -30° C to +50° C ; max delta T of wiring: 125 °C				

Technical data are given for information only, without commitment; before ordering ask for confirmation of technical data, in particular on dimensions, performance, pressure.

for all options of plungers, manual overrides and nuts for coils see tab.3100



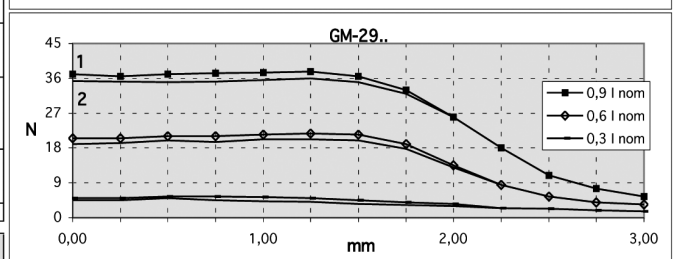
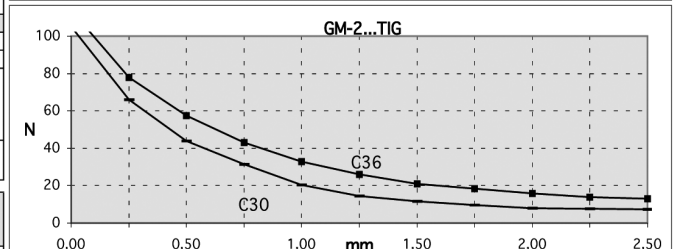
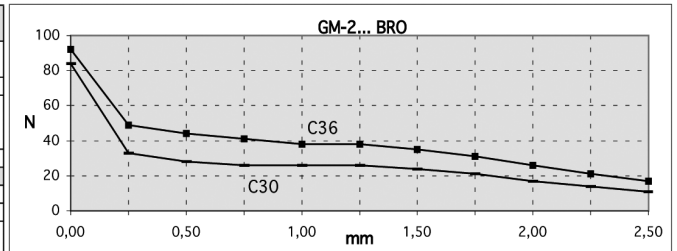
EXECUTIONS - dimensions in mm		1- pulling, plunger arranged for connection to spool	2- pulling, with conic end push rod 55-60 Hrc
units are shown in rest position (coil deenergized)		3- manual override for pulling versions, operation is by screwing off the knob; to release screw in the knob	4- pushing, loose push rod
dimension X : on request	spring : on request		5- pushing, with conic end push rod 55-60 Hrc

# Type GM-2

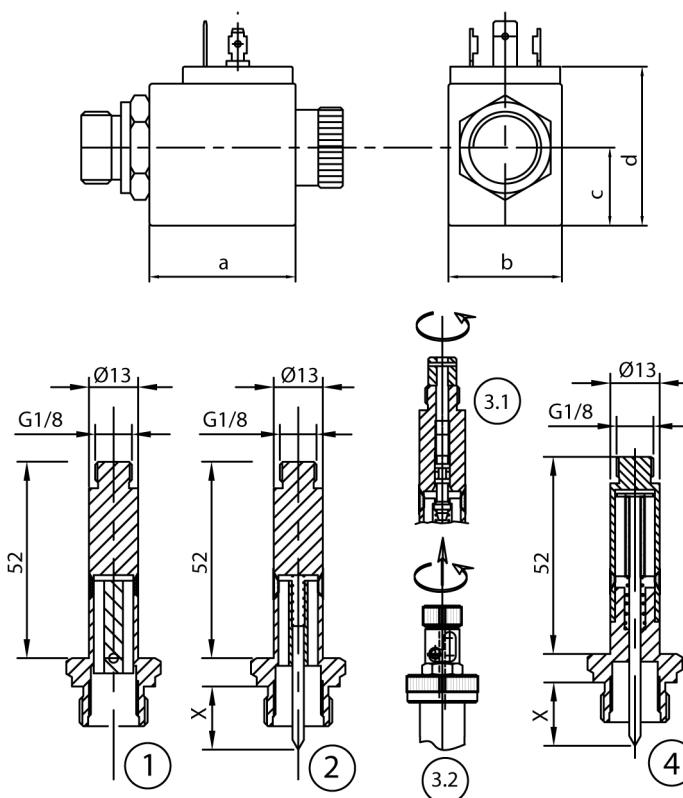
PUSH, PULL, DOUBLE AND PROPORTIONAL  
EXT. DIA. OF TUBE 13 MM

3020  
ELECTROMAGNETIC SOLENOIDS

CHARACTERISTICS OF STANDARDIZED EXECUTIONS				
- other executions are available on request				
operation: pulling on/off-code GM-23..., pushing on/off-code GM-20				
on/off double, pulling and pushing-code GM-26..., proportional code GM-29...				
	external	internal	external	internal
standardised threads (interface to the valve)	3/4"-16UNF	1/2"-20UNF	M18x1,5	M13x1
-other variants: on request	5/8"-18UNF	1/2"-20UNF	M18x1,5	1/2"-20UNF
max dynamic pressure: up to 250 and 350 bar	3/4"-16UNF	M13x1	M20x1,5	M13x1
<b>1- ON/OFF SOLENOIDS</b>				
stroke: on request	push rod options : see below			
manual override: available for all versions				
curves of force-stroke: diagrams refer to supply 0,66 Vnom. and stroke back from end.				
Note: curves can be modified according to operating characteristics requested by the valve.				
Versions GM-2...BRO differ from versions GM-2...TIG for a different magnetic structure of tube				
<b>2-PROPORTIONAL SOLENOIDS</b> - see also tab.3200				
nominal stroke: 1,5 mm - extra strokes on request				
air bleed-off valve or manual override: available on request - see tab. 3200				
general notes: recommended supply is by closed-loop current with dither or PWM; this supply could produce undesired vibrations on regulation, that are easily damped by providing solenoid plunger with throttling orifices. Coils are plastic encapsulated, ED 100%; they are preferably designed with low resistance and inductance for the best dynamic performance of system.				
curves of force-stroke: diagrams refer to different supply of current; curve 1 is with stroke back from end, curve 2 with stroke forward. Force-stroke curves can be modified on request				
<b>STANDARD COILS - ED 100 %</b> - see tables 5020 & 5025				
- other voltages, electric powers, insulation class, electric terminals, ED : on request				
all coils can be supplied with transient suppressor Z-diode moulded-in				
code of (1)	electric connection	supply voltage - V (+/- 10%) available for all executions	nominal power (3)	insulation class
C30A***	AMP-Junior	DC: 12; 24; 48 & 21,6; 43,2; 98; 196 (2)	18W	F
C30D***	DIN43650	AC 50 Hz: 24; 42; 48; 110; 220; 380	28 VA	F
C30C***	flying leads	AC 60 Hz: 24;110; 220	28 VA	F
C36A***	AMP-Junior	DC: 12; 24 & 21,6 ; 98; 196 (2)	22 W	H
C36D***	DIN43650	AC 50 Hz: 110; 220	32 VA	H
C36C***	flying leads			
C36K***	Kostal			
(1) *** code must be completed by voltage supply and requested power				
(2) voltages normally provided for AC supply at 24, 48, 110, 220 with rectifier				
(3) holding value at cold coil; inrush power for AC coils is about 3,5 time the holding value				
ambient temperature: -30° C to +50° C; max delta T of wiring: 125 °C				
Technical data are given for information only, without commitment; before ordering ask for confirmation of technical data, in particular on dimensions, performance, pressure.				



for all options of plungers, manual overrides and nuts for coils see tab.3100 and 3200



	a	b	c	d
C30 [mm]	38.6	30	20.5	42
C36 [mm]	38.5	36	23.5	47.8

EXECUTIONS - dimensions in mm		2- pulling, 4- pushing - with conic end push rod 55-60 Hrc		5- pushing, on-off and proportional, loose push rod	
units are shown in rest position (coil deenergized)		manual override-pulling versions: 3.1 screwed type, screw off knob to operate		manual override-pushing versions: 6.1 operation by pushing knob or 6.2 by	
dimension X : on request		spring : on request		screwing them or 6.3 by pushing and twisting by 90° for locking in position	
1- pulling, plunger arranged for connection to spool		plunger; screw-in to release. 3.2 twist & lock device, to operate the device rotate by 90° knob and release; push and rotate by 90° to exclude the device		7- double, push-pull, plunger arranged for connection to spool	

# Type GM-3

PUSH AND PULL  
EXT. DIA. OF TUBE 14 MM

3030  
ELECTROMAGNETIC SOLENOIDS

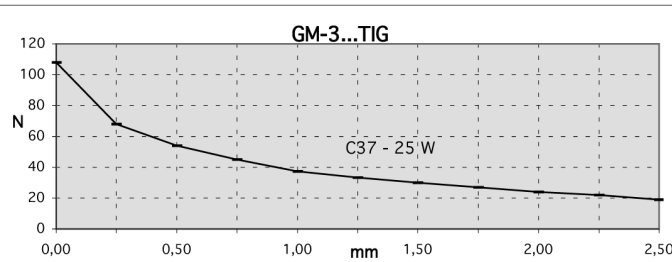
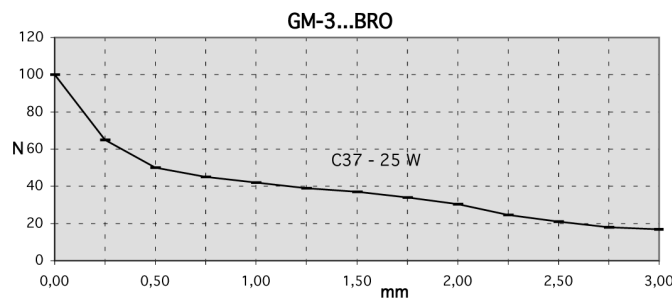
CHARACTERISTICS OF STANDARDIZED EXECUTIONS			
- other executions are available on request			
operation: pulling on/off-code GM-33..., pushing on/off-code GM-30..			
stroke: on request		push rod options : see below	
manual override: available for all versions			
standardised threads	external	internal	external
(interface to the valve)	3/4"-16 UNF	1/2"-20 UNF	M18x1,5
- other variants: on request			M18x1,5 M13x1
max dynamic pressure: up to 250 and 350 bar			
curves of force-stroke: diagrams refer to supply 0,66 Vnom. and stroke back from end stop. Note: curves can be modified according to operating characteristics requested by the valve. Versions GM-3...BRO differ from versions GM-3...TIG for a different magnetic structure of tube			

STANDARD COILS - ED 100% - see tables 5030 & 5035  
- other voltages, electric powers, insulation class, electric terminals, ED : on request  
all coils can be supplied with transient suppressor Z-diode moulded-in

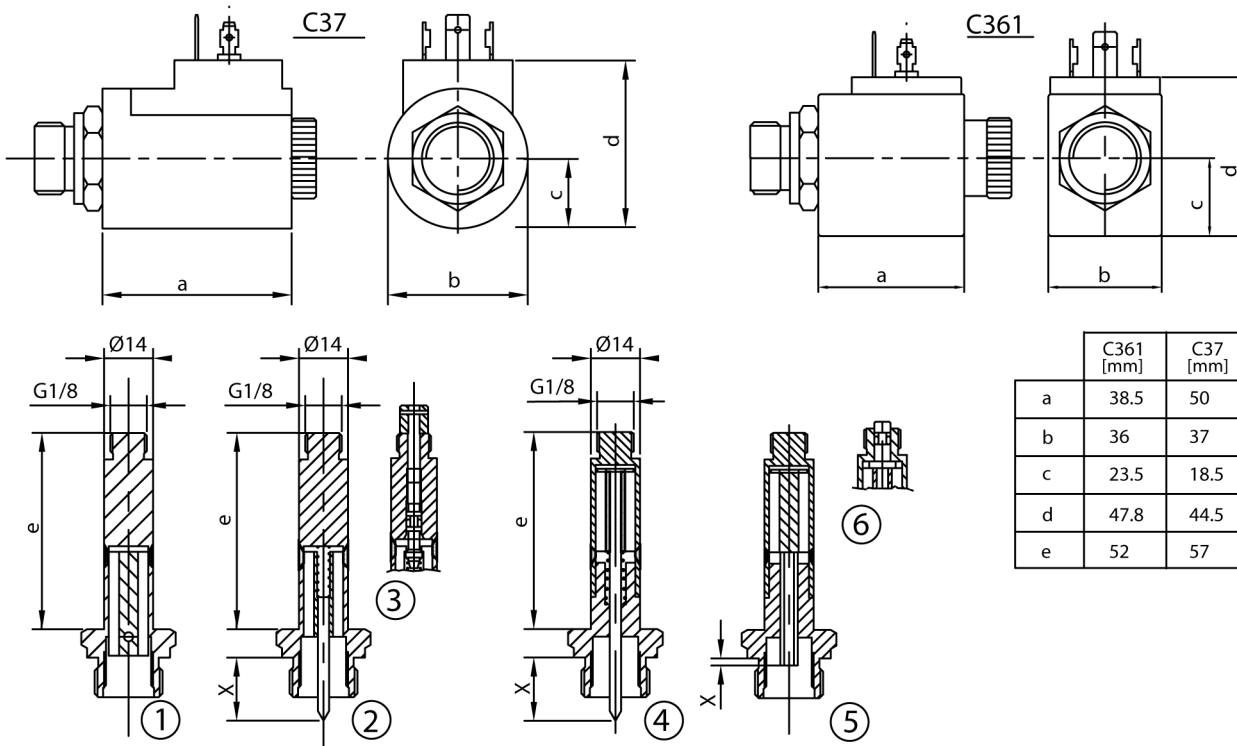
code of (1) coil	electric connection	supply voltage - V (+/- 10%) available for all executions	nominal power (3)	insulation class
C36A**X04	AMP-Junior	DC: 12; 24; 48 & 21,6; 43,2; 98; 196 (2)	22W	H
C36D**X04	DIN43650			
C36C**X04	flying leads			
C37A***	AMP-Junior	DC: 12; 24; 48 & 21,6; 43,2; 98; 196 (2)	20 or 25 W	F, H respect.
C37D***	DIN43650			
C37C***	flying leads			
C37K***	Kostal	AC 50 Hz: 24; 48; 110; 220; 240; 380	35 VA	F
		AC 60 Hz: 24;110; 220	35 VA	F

(1) \*\*\* code must be completed by voltage supply and requested power  
(2) voltages normally provided for AC supply at 24, 48, 110, 220 with rectifier  
(3) holding value at cold coil; inrush power for AC coils is about 3,5 time the holding value  
ambient temperature: -30° C to +50° C ; max delta T of wiring: 125 °C

Technical data are given for information only, without commitment; before ordering ask for confirmation of technical data, in particular on dimensions, performance, pressure.



for all options of plungers, manual overrides and nuts for coils see tab.3100



	C361 [mm]	C37 [mm]
a	38.5	50
b	36	37
c	23.5	18.5
d	47.8	44.5
e	52	57

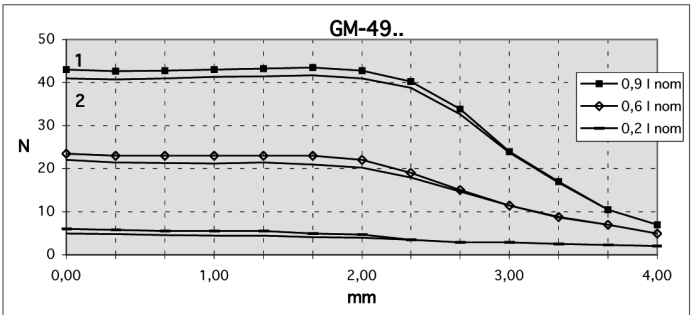
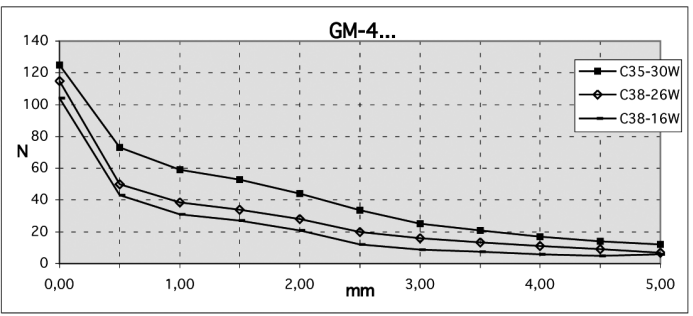
EXECUTIONS - dimensions in mm			
units are shown in rest position (coil deenergized)		1- pulling, plunger arranged for connection to spool	4- pushing, with conic end push rod 55-60 Hrc
dimension X : on request	spring : on request	2- pulling, with conic end push rod 55-60 Hrc	5- pushing, loose push rod
		3- manual override for pulling versions, operation is by screwing off the knob; to release screw in the knob	6- manual override for pushing versions, operation is by pushing or by screwing the extended pin

# Type GM-4

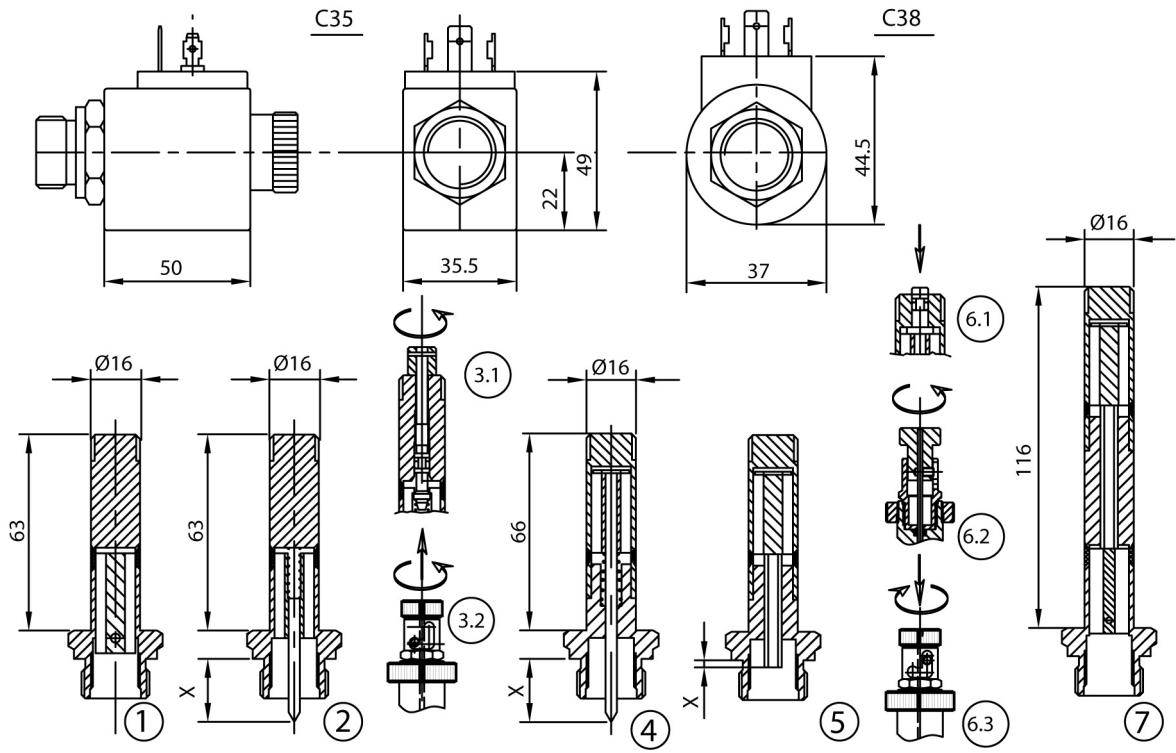
PUSH, PULL, DOUBLE AND PROPORTIONAL  
EXT. DIA. OF TUBE 16 MM

3040  
ELECTROMAGNETIC SOLENOIDS

CHARACTERISTICS OF STANDARDIZED EXECUTIONS				
- other executions are available on request				
operation: pulling on/off-code GM-43..., pushing on/off-code GM-40... on/off double, pulling and pushing-code GM-46..., proportional code GM-49...				
standardised threads (interface to the valve)	external	internal	external	internal
	3/4"-16UNF	1/2"-20UNF	M20x1,5	M14x1
-other variants: on request	7/8"-14UNF	1/2"-20UNF	M22x1,5	M16x1
max dynamic pressure: up to 250 and 350 bar				
<b>1- ON/OFF SOLENOIDS</b>				
stroke: on request		push rod options : see below		
manual override: available for all versions				
curves of force-stroke: diagrams refer to supply 0,66 Vnom. and stroke back from end stop. Note: curves can be modified according to operating characteristics requested by the valve.				
<b>2-PROPORTIONAL SOLENOIDS</b> - see also tab.3200				
nominal stroke: 2 mm - extra strokes on request				
air bleed-off valve or manual override: available on request - see table 3200				
general notes: recommended supply is by closed-loop current with dither or PWM; this supply could produce undesired vibrations on regulation, that are easily damped by providing solenoid plunger with throttling orifices. Coils are plastic encapsulated, ED 100%; they are preferably designed with low resistance and inductance for the best dynamic performance of system.				
curves of force-stroke: diagrams refer to different supply of current; curve1 is with stroke back from end, curve2 with stroke forward. Force-stroke curves can be modified on request				
<b>STANDARD COILS - ED 100%</b> - see tables 5040 & 5045				
- other voltages, electric powers, insulation class, electric terminals, ED : on request all coils can be supplied with transient suppressor Z-diode moulded-in				
code of (1) coil	electric connection	supply voltage - V (+/- 10%) available for all executions	nominal power (3)	insulation class
C35A*** C35D*** C35C*** C35K***	AMP-Junior DIN43650 flying leads Kostal	DC: 12; 24; 48 & 21,6; 43,2; 98; 196 (2)	30 W	H
C38A*** C38D*** C38C*** C38K***	AMP-Junior DIN43650 flying leads Kostal	DC: 12; 24; 48 & 21,6; 43,2; 98; 196 (2) AC 50 Hz and 60 Hz: 24;110; 220	16 or 26 W 50 VA	F, H respect. H
(1) *** code must be completed by voltage supply and requested power (2) voltages normally provided for AC supply at 24, 48, 110, 220 with rectifier (3) holding value at cold coil; inrush power for AC coils is about 3,5 time the holding value ambient temperature: -30° C to +50° C ; max delta T of wiring: 125 °C				
Technical data are given for information only, without commitment; before ordering ask for confirmation of technical data, in particular on dimensions, performance, pressure.				



for all options of plungers, manual overrides and nuts for coils see tab.3100 and 3200



EXECUTIONS - dimensions in mm		
units are shown in rest position (coil deenergized)	2- pulling, 4- pushing - with conic end push rod 55-60 Hrc	5- pushing, on-off and proportional, loose push rod
dimension X : on request	manual override-pulling versions: 3.1 screwed type, screw off knob to operate plunger; screw-in to release. 3.2 twist & lock device, to operate the device rotate by 90° knob and release; push and rotate by 90° to exclude the device	manual override-pushing versions: 6.1 operation by pushing knob or 6.2 by screwing them or 6.3 by pushing and twisting by 90° for locking in position
1- pulling, plunger arranged for connection to spool		7- double, push-pull, plunger arranged for connection to spool

## Type GM-5

PUSH, PULL, DOUBLE AND PROPORTIONAL  
EXT. DIA. OF TUBE 19 MM

3050  
ELECTROMAGNETIC SOLENOIDS

### CHARACTERISTICS OF STANDARDIZED EXECUTIONS

- other executions are available on request

**operation:** pulling on/off-code GM-53... pushing on/off-code GM-50..  
on/off double, pulling and pushing-code GM-56... proportional code GM-59..

standardised threads (interface to the valve) -other variants: on request	external	internal	external	internal
	1 5/16"-12UN	M24x1,5	M33x2	M24x1,5
1 1/16"-12UN	-----	-----	-----	-----

**max dynamic pressure:** up to 160 and 250 bar

**ON/OFF SOLENOIDS**

**stroke:** on request      **push rod options:** see below

**manual override:** available for all versions

**curves of force-stroke:** diagrams refer to supply 0,66 Vnom. and stroke back from end stop.  
Note: curves can be modified according to operating characteristics requested by the valve.

**2-PROPORTIONAL SOLENOIDS - see also tab.3200**

**nominal stroke:** 2,5 mm - extra strokes on request

**air bleed-off valve or manual override:** available on request - see tab.3200

**general notes:** recommended supply is by closed-loop current with dither or PWM; this supply could produce undesired vibrations on regulation, that are easily damped by providing solenoid plunger with throttling orifices. Coils are plastic encapsulated, ED 100%; they are preferably designed with low resistance and inductance for the best dynamic performance of system.

**curves of force-stroke:** diagrams refer to different supply of current; curve1 is with stroke back from end, curve2 with stroke forward. Force-stroke curves can be modified on request

### STANDARD COILS - ED 100% - see tables 5050 & 5055

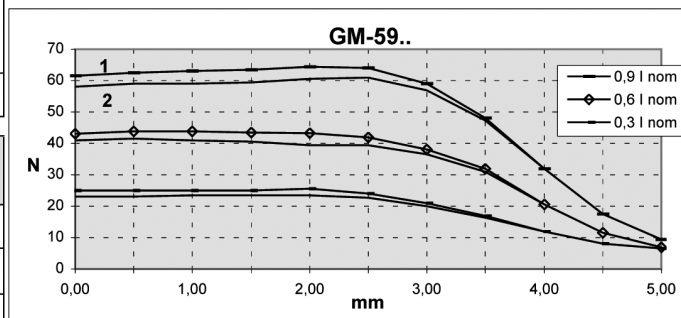
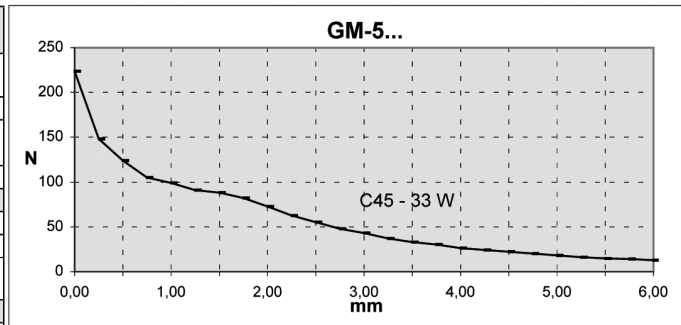
- other voltages (3), electric powers, insulation class, electric terminals, ED : on request  
all coils can be supplied with transient suppressor Z-diode moulded-in

code of (1) coil	electric connection	supply voltage - V (+/- 10%) available for all executions	absorbed power (3)	insulation class
<b>C45D***</b>	DIN43650	DC: 12; 24; 48	33 W	H
<b>C45K***</b>	Kostal	& 21,6; 43,2; 98; 196 (2)	33 W	H

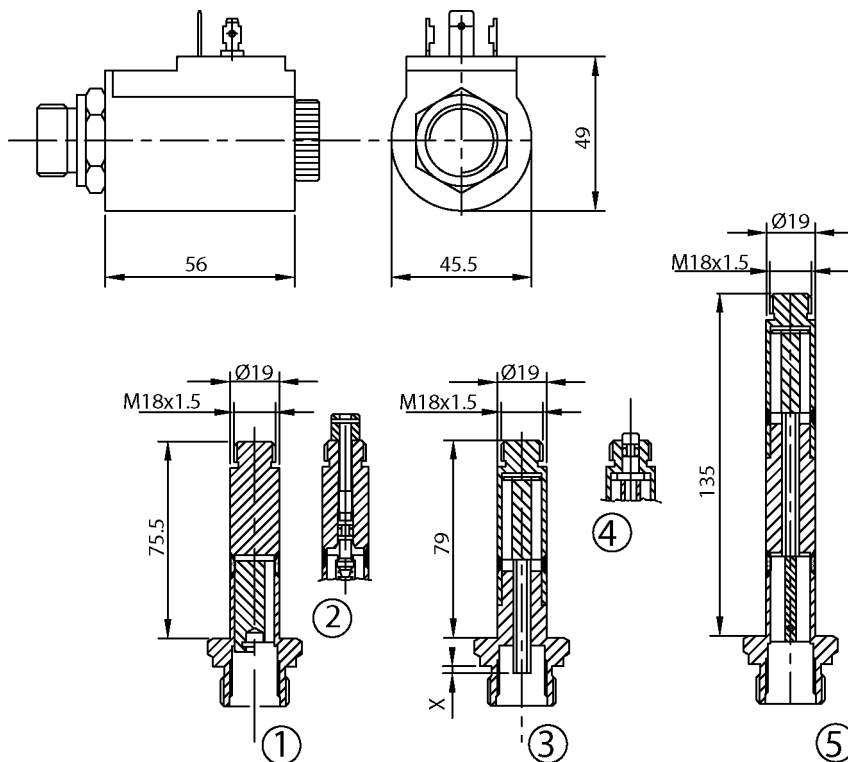
(1) \*\*\* code must be completed by voltage supply and requested power  
(2) voltages normally provided for AC supply at 24, 48, 110, 220-230 with rectifier  
(3) executions for direct supply from AC net are available : code C400 e C402 - see tab. 5100 & 5105 to be associated to stems designed for direct supply from AC voltage - see tab. 3055

**ambient temperature:** -30° C to +50° C ; max delta T of wiring: 125 °C

Technical data are given for information only, without commitment; before ordering ask for confirmation of technical data, in particular on dimensions, performance, pressure.



for all options of plungers, manual overrides and nuts for coils see tab.3100 and 3200



EXECUTIONS - dimensions in mm		1- pulling, plunger arranged for connection to spool	4- manual override for pushing versions, operation is by pushing the extended pin
units are shown in rest position (coil deenergized)		2- manual override for pulling versions, operation is by screwing off the knob; to release screw in the knob	5- double, push-pull, plunger arranged for connection to spool
dimension X : on request	spring : on request	3- pushing, on-off and proportional, loose push rod	

# Type GMA-6

EX-PROOF EXECUTION  
EXTERNAL DIAMETER 45 MM

3060  
ELECTROMAGNETIC SOLENOIDS

### CHARACTERISTICS OF STANDARD EXECUTIONS

**general remarks:**

- ex-proof solenoids according to ATEX 94/9/CE
- code & protection class CE 0722 Ex II 2 G EExd II C T5 or CE 0722 Ex II 2 G EExd II C T6.
- sealed and tight execution, protection degree IP 67 according to IEC 144
- surface protection of solenoid: nickel coating, thickness 7 micron min.
- electric connection: solenoids are supplied with 3-wire cable, with length on request, already wired to coil. Earth connection is realised by cable of minimum section 1,5 mm<sup>2</sup> connected internally to solenoid, it can be also realized by using the terminal provided externally to solenoid body. Electric wiring must following the concerned ex-proof norms according to ATEX
- coil is secured to tube by screwing the nut - torque 6 Nm ± 1 - across the coil.
- Nut must be then locked by the plug present on it. Conformity of unit to the norms is not granted if coil is used separately from its electromagnetic tube.

**operation:** on/off pulling code GMA-63..., on/off pushing code GMA-60..

on/off double push-pull code GMA-66..

proportional executions are available on request.

**connection threads or interface to the valve:** on request

**max. dynamic pressure:** up to 350 bar

**stroke:** on request

**push-rod and plunger options:** see below

**manual override:** available for all versions

**curves of force-stroke:** diagrams refer to supply 0,66 V<sub>nom.</sub> and stroke back from end stop. Note: curves can be modified according to operating characteristics requested by the valve. Diagrams shows 2 typical characteristics obtainable for different executions, one with reduced stroke the other one with longer stroke respectively for versions EExd II C T5 and T6

### STANDARD COILS - ED 100%

Coils are designed for DC supply and they are available for voltages from 12 to 250 VDC, for AC supply coils are designed with built-in bridge rectifier, they are available for supply voltages from 24 to 250 VAC.

Coils are supplied with 3-wire cable with silycon-rubber protective covering.

Wires have section 1,5 mm<sup>2</sup> - earth connection cable is green-yellow.

Electric connections must be realized according to the relevant ex-proof norms according to ATEX.

**ambient temperature :** from -15 to +40 °C

**Labelling :** solenoid label indicates supply voltage, protection class EExd, certification number by CESI and maximum absorbed power.

Note: copy of omologation certificate is available on request - CESI 03 ATEX 212

**Electric power consumption**

**EExd IIC T5**

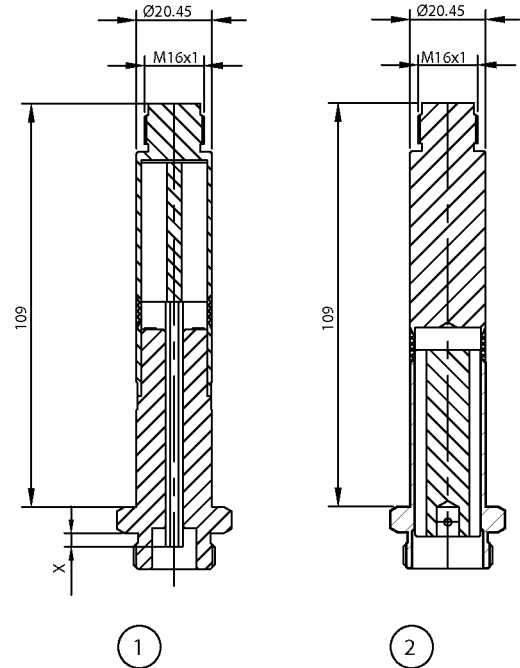
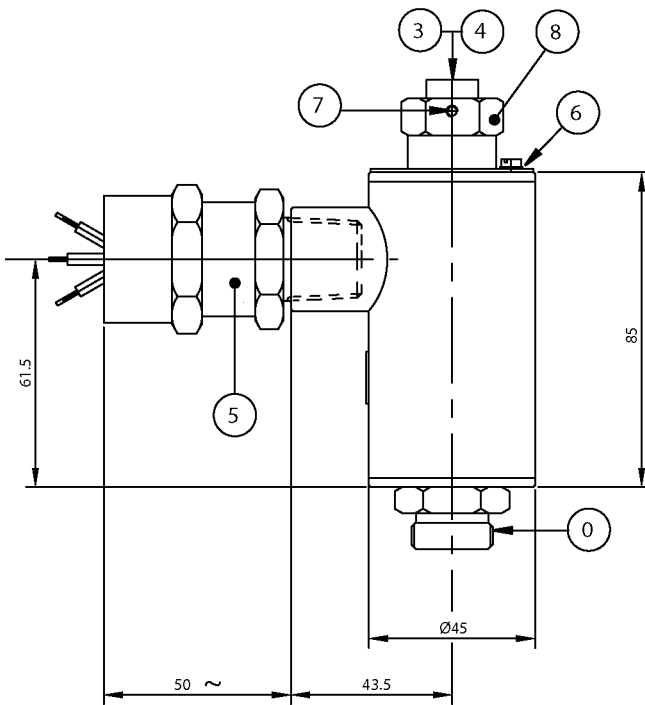
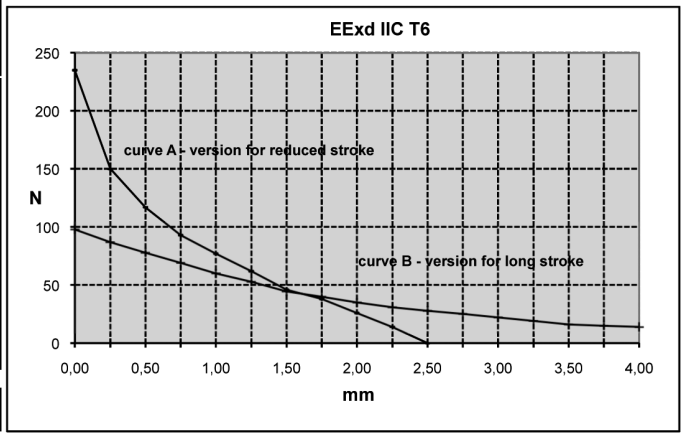
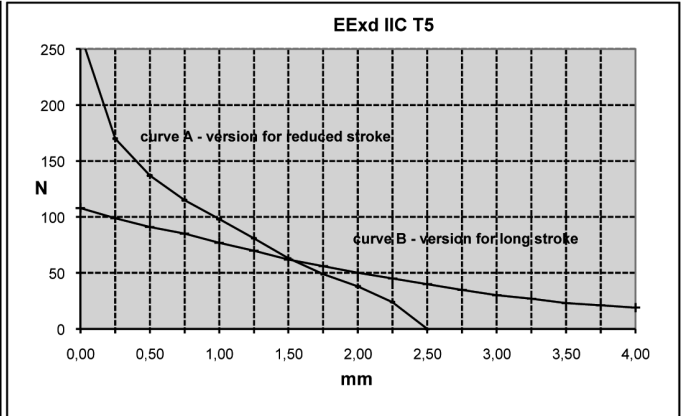
**EExd IIC T6**

**with warm coil**

max. 11 W

max. 7 W

Technical data are given for information only, without commitment; before ordering ask for confirmation of technical data, in particular on performance and pressures.



### EXECUTIONS - dimensions in mm

units are shown in rest position (coil deenergized)

**dimension X and springs :** on request

**0-** interface to the valve : on request

**1-** pushing and proportional, loose push rod

**2-** pulling, plunger arranged for connection to spool

**3-** manual override (if present) for pulling versions, operation is by screwing off the knob; to release screw in the knob

**4-** manual override (if present) for pushing versions, operation is by pushing the extended pin

**5-** normalised cable gland - fixing torque 8 Nm ± 1 - device has threaded attachment 1/2 " conical-ISO 7/1

**6-** earth connection screw

**7-** threaded plug to lock the nut 8 for retaining coil

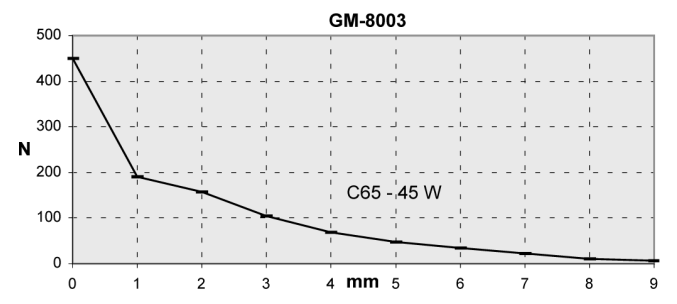
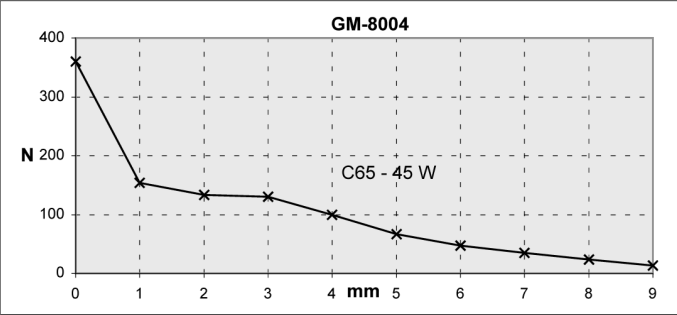
**8-** nut for retaining the coil - fixing torque 6 Nm ± 1

# Type GM-8

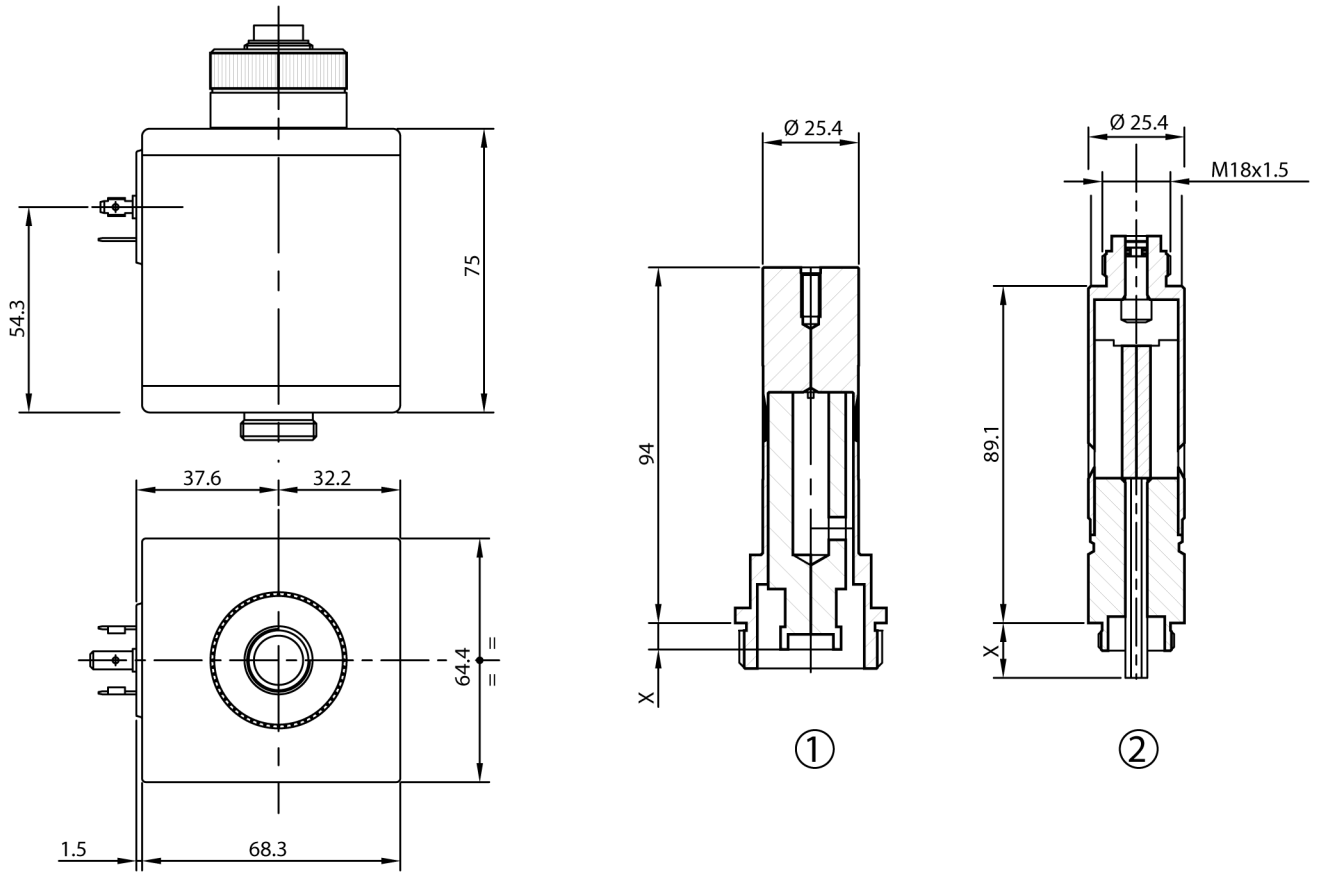
PULL AND PUSH VERSION  
EXT. DIA. OF TUBE 25,4 MM

3080  
ELECTROMAGNETIC SOLENOIDS

CHARACTERISTICS OF STANDARDIZED EXECUTIONS				
- other executions are available on request				
operation: pulling on/off -code GM-83..., pushing on/off -code GM-80..				
standardised threads (interface to the valve) -other variants: on request	external	internal		
	M22x1,5	-----		
max dynamic pressure: up to 160 bar				
<b>1- ON/OFF SOLENOIDS</b>				
stroke: on request		push rod options : see below		
manual override: available for all versions				
curves of force-stroke: diagrams refer to supply 0,66 Vnom. and stroke back from end stop. Note: curves can be modified according to operating characteristics requested by the valve.				
<b>STANDARD COILS - ED 100% - see table 5080</b>				
- other voltages, electric powers, insulation class, electric terminals, ED : on request				
all coils can be supplied with transient suppressor Z-diode moulded-in				
code of (1) coil	electric connection	supply voltage - V (+/- 10%) available for all executions	absorbed power (3)	insulation class
C65D***	DIN43650	DC: 12; 24; 48	36 or 45 W	F or H
C65D**X	DIN43650	21,6; 43,2; 98; 196 (2)	60 W	H
(1) *** code must be completed by voltage supply and requested power				
(2) voltages normally provided for AC supply at 24, 48, 110, 220 with rectifier				
(3) holding value at cold coil				
ambient temperature: -30° C to +50° C ; max delta T of wiring: 125 °C				
Technical data are given for information only, without commitment; before ordering ask for confirmation of technical data, in particular on dimensions, performance, pressure.				



for all options of plungers, manual overrides and nuts for coils see tab.3100



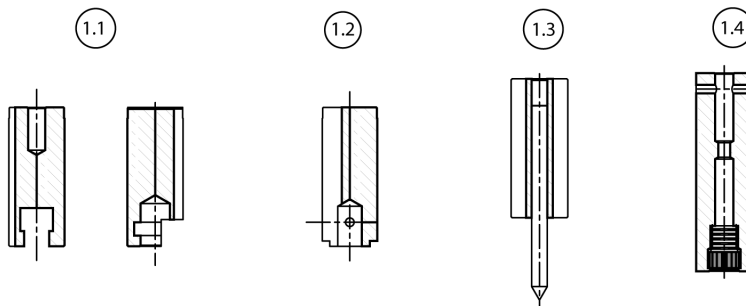
EXECUTION pulling (1) and pushing with free push rod (2) - dimensions in mm	dimension X & stroke: on request
units are shown with plunger in position further to coil energizing	interface to the valve : on request

## OPTIONS OF SUPPLY

### PLUNGERS, MANUAL OVERRIDES AND COIL NUTS

#### 1 PLUNGERS

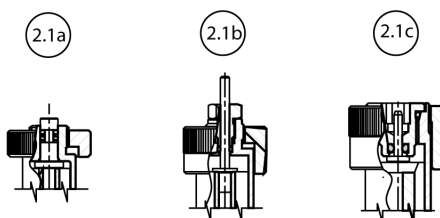
- 1.1 with slot for connection to spool, without seat for spring
- 1.2 with pin connection
- 1.3 with ground conic end, hardness 60 Hrc
- 1.4 with rubber or PTFE sealing element



#### 2 MANUAL OVERRIDES

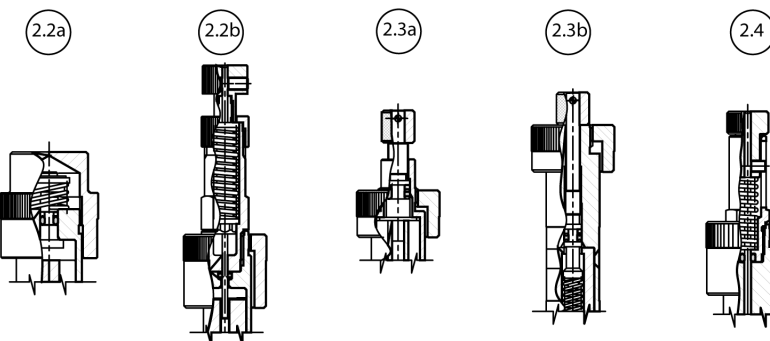
##### 2.1 free return

- 2.1a standard for pushing & push-pull stems
- 2.1b extended
- 2.1c for operation in presence of high pressure



##### 2.2 spring return

- 2.2a 2-position, for pushing & push-pull stems
- 2.2b 3-position for push-pull stems



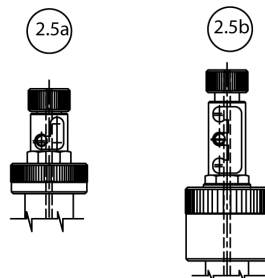
##### 2.4 spring return for pulling stems

##### 2.3 screwed

- 2.3a for pushing stems
- 2.3b for pulling stems

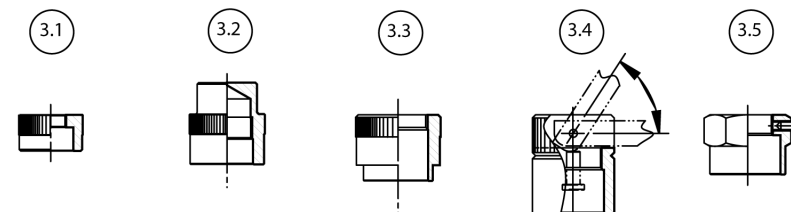
##### 2.5 twist and lock

- 2.5a 2-position, for pushing & pulling stems
- 2.5b 3-position for push-pull stems



#### 3 NUTS FOR COILS

- 3.1 standard
- 3.2 with environmental protection of stem
- 3.3 with electric continuity to coil earth
- 3.4 arranged for lever operation
- 3.5 lockable on stem





## OPTIONS OF SUPPLY

FOR PROPORTIONAL SOLENOIDS:  
AIR BLEED-OFF VALVE, BIAS SPRINGS, MANUAL OVERRIDES

### GENERAL REMARKS AND NOTES ON VARIOUS OPTIONAL DEVICES AVAILABLE FOR PROPORTIONAL SOLENOIDS

#### Air bleed-off valve

Air bleed-off valve is recommended to have an immediate purge of air present in the solenoid at first start-up. Presence of air might cause instability and noise during regulation. Valve is composed by a sphere hold by a screwed plug with hexagonal head of 3 mm. Bleed-off is obtained by loosening the plug by half a turn then waiting the time necessary to have a complete purge of air. At the end of operation plug must be screwed-in to secure sealing of unit.

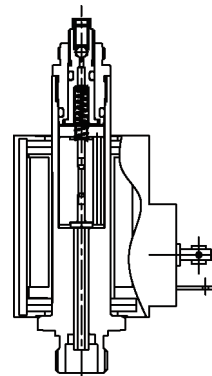
#### Bias springs

They have a load of some tenth of grams and are assembled inside to solenoid. They keep plunger of solenoid always across to regulation element of valve, allowing quick response times at start up as well a mechanical compensation of dimensional variations of strokes and rest positions.

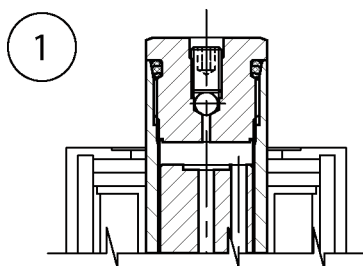
#### Manual override devices

They are available in screwed execution, for a micrometric adjustment of stroke or in pushing execution, for on-off operation.

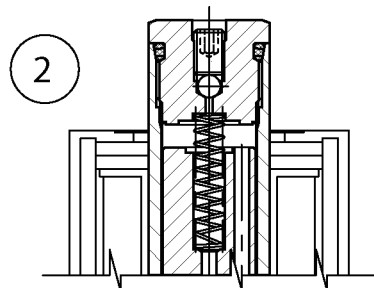
They can be associated to air bleed-off valves and bias springs.



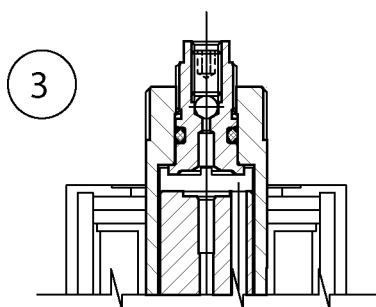
### MAIN OPTIONS - other options are available



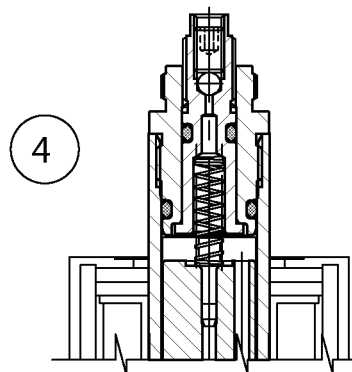
**1 AIR BLEED-OFF VALVE**



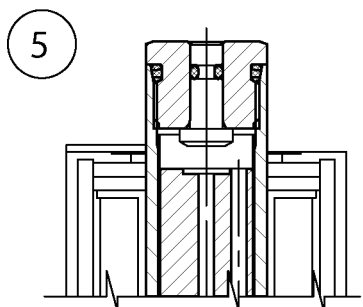
**2 AIR BLEED-OFF VALVE PLUS BIAS SPRING**



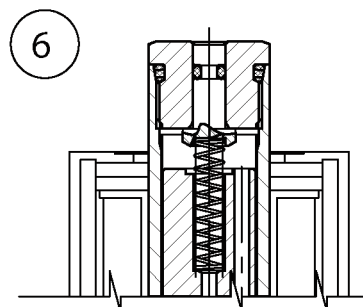
**3 MANUAL OVERRIDE OF SCREW TYPE**  
*for micrometric adjustment of stroke & air bleed-off valve*



**4 MANUAL OVERRIDE OF SCREW TYPE**  
*for micrometric adjustment adjustment of stroke plus bias spring & air bleed-off valve*



**5 MANUAL OVERRIDE**  
**ON-OFF OPERATION**



**6 MANUAL OVERRIDE**  
**ON-OFF OPERATION PLUS BIAS SPRING**

### SOLENOID

the solenoid is the unit composed by the magnetic tube, in which the mobile plunger is sliding and by an electric coil. Energising of electric coil produces the movement of plunger that provides a force, whose value increases as value of current increases and as plunger approaches to its mechanical end stop that represents the fixed pole of solenoid. The plunger is linked, directly or indirectly, to the regulation mechanism of valve or to the mechanism that operates; it can operate according to three different options:

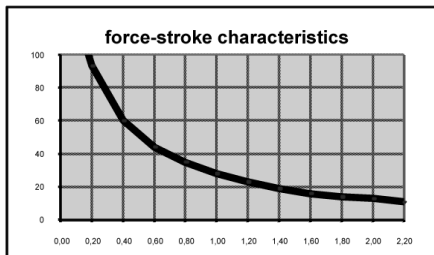
**pull** - plunger pulls the regulation mechanism associated to them

**pushing** - plunger pushes the regulation mechanism associated to them

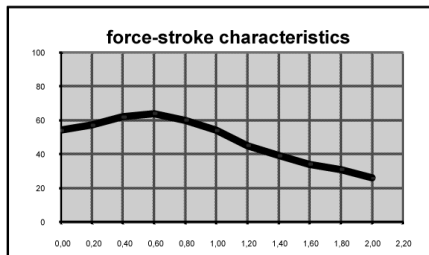
**double, push-pull** - this is the combination of previous ones where one section is acting as pulling, other one as pushing.

Every solenoid is characterised by a specific force-stroke diagram whose behaviour can be modified, within certain limits, with a high flexibility. The possibility of having customised characteristics of force-stroke allows the optimising of performances and dimensions of solenoid, with practical advantages to applications.

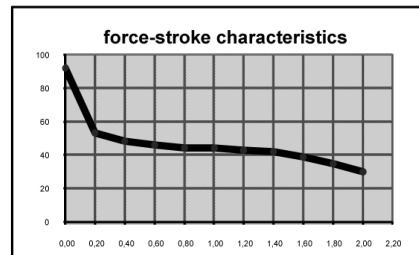
Force-stroke characteristics currently available from solenoids are shortly indicated in the following examples:



1 - raising force vs. distance



2 - large forces at long distance



3 - constant forces independently on distance

The force values are directly proportional to electric current to coil.

The electric current value is obtained dividing the voltage value and resistance value of coil:  $I = V / R$ ; the current intensity, even with constant value of supply voltage to coil, tends to reduce during the energising time, because the coil resistance increases because of overheating generated during the energising period of coil (effect Joule). The resistance value is stabilised after 2-3 hours of continuous supply, to a value that normally corresponds to 1,5 times of nominal resistance value of coil resistance. Reduction of current intensity, reduces consequently the force performance of solenoid. In the same way reductions on supply voltage value produces reduction of current and consequent reductions of performances in terms of force. Force diagrams contained in each Italmagneti data sheet refer to worse operating conditions that can be applied to solenoid i.e. to maximum coil overheating and to electric supply at 90% of nominal value.

### Environmental protections:

stems are supplied with antiwear surface protection (phosphatation, zinc or nickel coating etc.); on request other treatments are available. Coils, provided with seals and electric connectors properly assembled are protected against wet ambient and water inclusion. Specific protections are available for every application and working ambient; ex-proof executions are available as well.

### Definitions:

**Dynamic pressure** for electromagnetic tubes operating under pressure

this is the pressure value that, for working cycles operating with step variation of pressure between zero and max value, generates a plastic deformation and a consequent rupture within the tube.

### Burst pressure

this is the pressure limit value over which the tube is subject to rupture due to overpassing of resistance limits of composing materials.

### Overheating or delta T of coil

this is the value of temperature that is generated within the coil as consequence of continuous electric supply. The full temperature variation within the coil, from ambient temperature value to maximum stabilised value, is normally achieved in a time that, for Italmagneti coils, does not overpass three hours. The variation law of temperature within the coil has a behaviour logarithmic; overheating values corresponding to about 80% of maximum overheating value of any coil, are achieved normally within 10 minutes of continuous supply to coil at the nominal voltage. These indications are only supplied as indicative information, considering that in the practice these values vary not only as consequence of structure of coil, but also as consequence of thermic exchange characteristics of coils with the ambient.

### Insulation class of coils

this parameter defines the max limit of temperature, intended as the sum of the value of ambient temperature plus the coil overheating, i.e. the temperature generated by coil during its energising, over which coil can have serious structural damages and consequent out of service. Italmagneti coils are normally supplied in class H or F. Class H = T max. 180°C; class F = T max. 155°C

### ED or duty cycle of coil

this parameter indicates the maximum time to which coil can be continuously supplied at a voltage, within the stated tolerance limits, without any damage for its integrity. This is conventionally expressed as a percent value given by the following formula:  $Te / (Te + Td)$ , where  $Te$  is the time for which a continuous supply of coil produces the maximum value of allowed overheating (it normally corresponds to the limits stated for insulation class of coil),  $Td$  is the time necessary to coil to reach the ambient temperature from maximum temperature. It is always  $Td > Te$ .

ED 100% means that coil can be indefinitely supplied, within the tolerances stated for the electric voltage because, independently from duration of supply time, the maximum temperature limit is not reached anyway.

ED 50 % or lower values mean that coil must have a limited duration of supply always associated to minimum time in which coil must remain deenergised.

*Example: if a coil of class F reaches the temperature limit of 155°C in 10 minutes and if 40 minutes is the time necessary to have temperature from 155° to the value of ambient temperature, the ED of coil will be  $10 / 10 + 40 = 20\%$ . This is meaning that the coil can remain energised for a time the must not overpass the 20 % of total duration of working cycle.*

Corrective factors can be introduced once known the application and working cycles with duration of energising and deenergising periods. For a correct definition of ED for every coil it is suggested to consult Italmagneti considering that:

- to grant the coil integrity it is essential that its temperature consequent to electric supply and related to ambient temperature, will not overpass the maximum value of temperature stated for the insulation class of coil design
- it is necessary to keep coil energised for a time that will not overpass the time necessary to reach the maximum allowable coil temperature, it is so essential to know the temperature variation law of each coil
- it is essential to know the ambient thermic exchange capability and its maximum variations of temperature for any possible correction of ED values and for its proper evaluation.