

Technical Specification

TS-D4-00001

D4 Miniature Switch Series

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03	04.07.01	H. Zuber	138952				
02	27.09.00	H. Zuber	136063				
01	31.08.99	H. Zuber	131960				
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Approved							

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1 General

This technical specification applies to standard versions of the D4 miniature switch series.

1.1 General remarks

The TS-D4-00001 specification has validity only in connection with the current drawing. Different details on the drawing have priority.

Unless otherwise specified all technical details described herein have been defined under ambient climate according to EN 60068-1 with the switch being non-actuated.

Requirements showing differences to this specification need special consideration and agreement with Cherry.

We reserve the right to make minor changes designed to improve the products described.

The technical details contained herein relate solely to product specifications. We reserve the right to modify features without notice.

2 Scope

Examples for possible fields of application are switchgears for domestic appliances, office machines, electric tools, switching devices, slot machines, gaming machines or drive systems.

2.1 Application notes

D4 switches are products which should be accompanied with some advice. Selection of a switch type suitable for its special application requires agreement with Cherry.

D4 switches are designed to open and close electrical circuits. They must not be used for purposes other than intended.

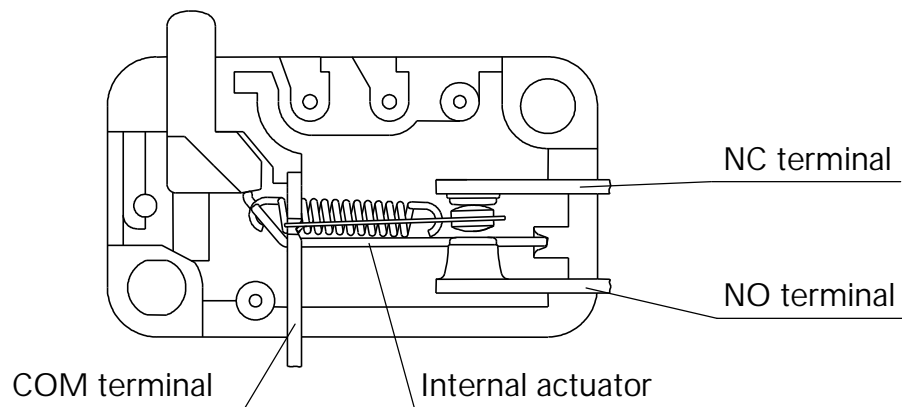
3 Switch description

Main features of the D4 miniature switch series:

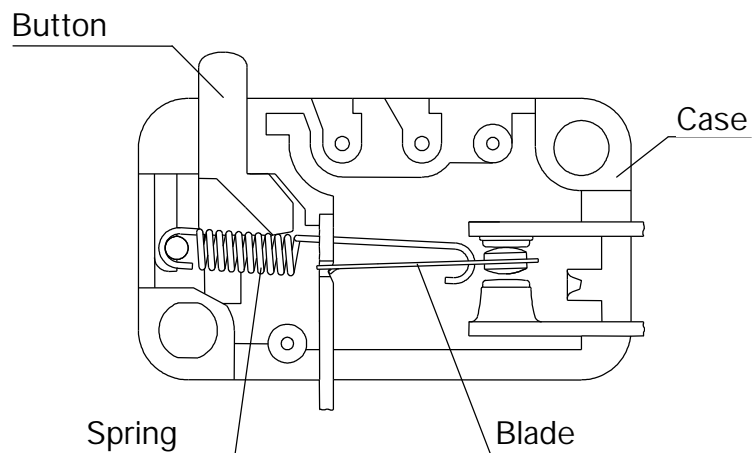
- Group D switches according to EN 61058-1 to be installed for indirect actuation in devices of protection level I
- Contact gap < 3 mm (μ)
- Design version A according to DIN 41635
- Operating force light and standard

3.1 Design

Switch version with „Light“ operating force:



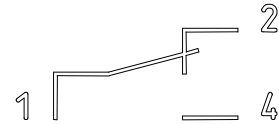
Switch version with „Standard“ operating force:



3.2 Switch marking

D4 switches are marked as follows:

- Manufacturer
- Contact symbol according to EN 60617
- Common type according to EN 61058-1
according to UL 1054
or Unique type
- Electrical rating according to EN 61058-1
according to UL 1054
- Cycles of operation according to EN 61058-1
- Temperature rating according to EN 61058-1
- Contact disconnection according to EN 61058-1
- Approval ENEC-VDE (Europe)
- Approval UL (Canada and USA)
- Date Code / Place of manufacture

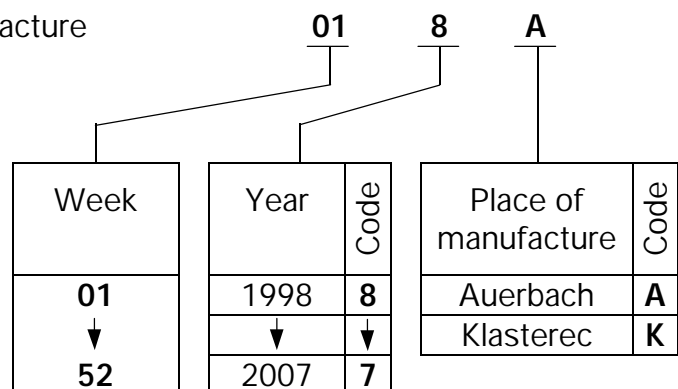


Example: D43Y
D43
D433-Q1LD
6(2)/250~
5A, 1/4HP
125/250VAC

5E4

40T85

μ



Remark for Common type:

Switches with operating force „Light“ are marked with „X“, switches with operating force „Standard“ are marked with „Y“.

Example: D43X, D43Y.

3.3 Numbering matrix

D		4	3	3	-
Electrical rating				Code	
EN 61058-1	UL 1054				
0,1 (0,05) A 250 V~	0,1 A 125/250 VAC			1	
3(1) A 250 V~	3A 125/250 VAC 1/10 HP 250 VAC			2	
6(2) A 250 V~	5 A 1/4 HP 125/250 VAC			3	
10(3) A 250 V~	10 A 1/2 HP 125/250 VAC			4	
16(4) A 250 V~	15 A 1/2 HP 125/250 VAC			5	
21(8) A 250 V~	21 A 250 VAC 1 HP 125 VAC 2 HP 250 VAC			8	

Temperature rating max.	Operating force	Code		
		Normally open	Normally closed	Double throw
85°C	Standard "Y"	1	2	3
	Light "X"	7	8	9
125°C	Standard "Y"	G	H	M
	Light "X"	N	P	R
150°C	Light "X"	S	T	U

Remarks:

- D41X and D42X with auxiliary actuator LD, LL, MD and ML:
Material of auxiliary actuator AI.
- D41X and D42X with auxiliary actuator JL, KL, TD, 0L, 1L and 3D:
Operating force as D43X.
- D45 not allowed with terminal type R.
- D48X available only for temperature rating max. 85°C with terminal types A, E, S, V, Y and Z.
- Terminal type C for D44 and D45 on request.

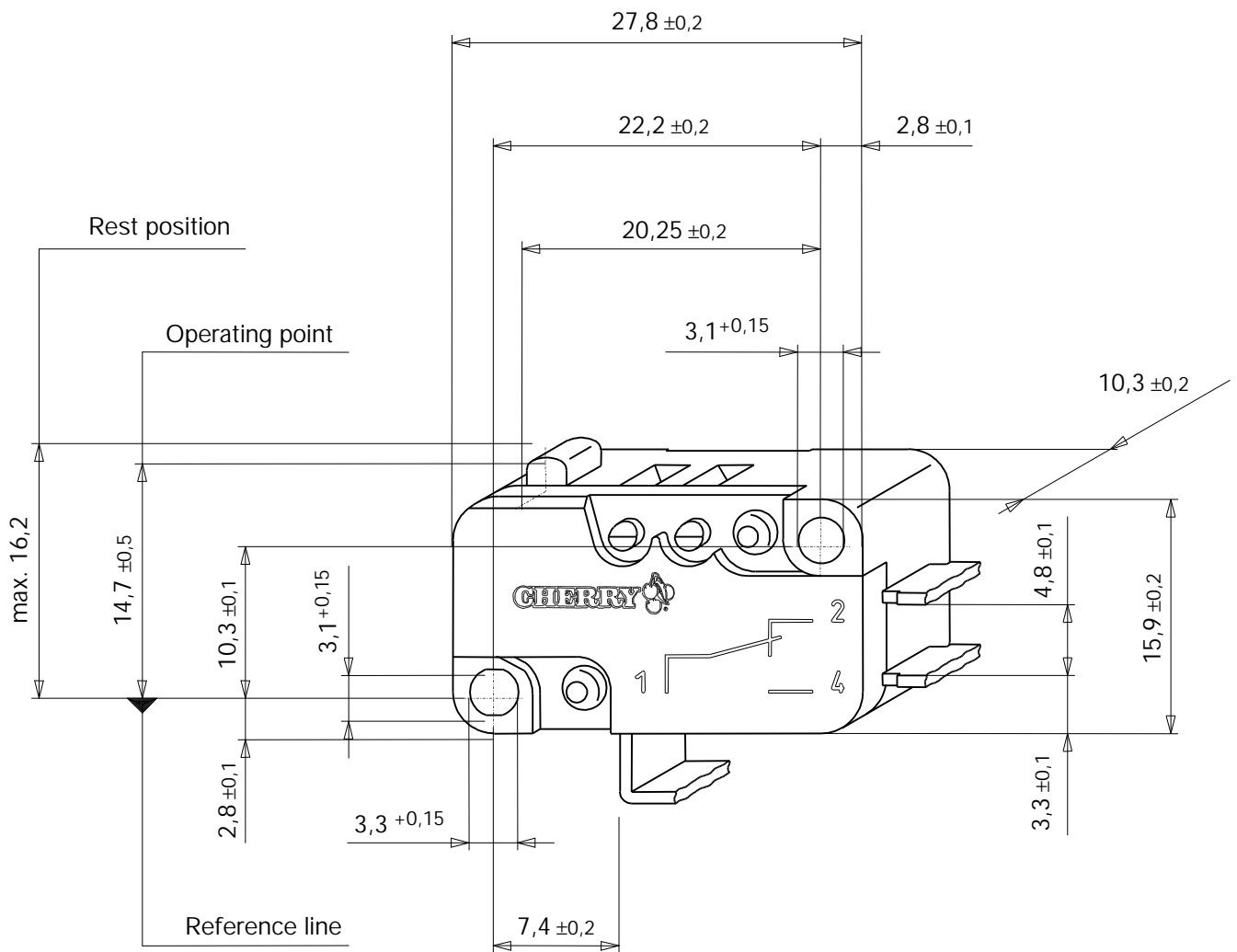
-		Q		1		L		D			
Terminal Type	Code	Terminal Configuration	Code	Auxiliary actuator	Pivot position	Code	Code				
							Length in mm				
							A	D	L		
Welding	A		1	without		AA					
Solder short	B		2	mounted	straight, St / Al	RP	L	21,2	35,6	69,9	
						FP	M	25,7	40,1	74,4	
Tab 2x2,8x0,8mm	C		3		straight, stainless steel	RP	J	21,2	35,6	69,9	
						FP	K	25,7	40,1	74,4	
Tab 6,3x0,8mm COM extended	E		4		with roller	RP	R	20,6	34,1		
						FP	T	25,1	38,6		
PCB	P		5		with simulated roller	RP	S	20,6			
						FP	U	25,1			
Tab 4,8x0,8mm	Q		8		snapped on	straight, stainless steel	RP	0	21,2	35,6	69,9
							FP	1	25,7	40,1	74,4
Tab 4,8x0,5mm	R		9	with roller, stainless steel		RP	2	20,6	34,1		
						FP	3		38,6		
Solder with Temp.-Stop	S		A								
Tab 6,3x0,8mm	V										
Screw	W		B								
Tab 6,3x0,8mm Spacing 5mm	Y										
Tab 6,3x0,8mm Spacing 7mm	Z	Special designs	G								

Remarks:

- Standard terminals:
A1, B8, C1, C3, E5, P4, P5, PA, PB, Q1, Q2, Q3, R1, R2, R3, S1, V1, V2, V3, W9, Y5, Z5
- Code special designs:
The last two digits are continuously identified from AA, AB, etc. to ZZ.

4 Dimensions / Versions

4.1 Dimensions

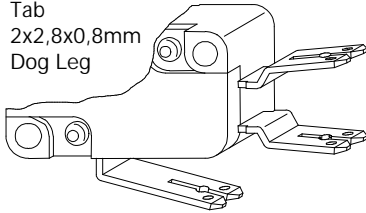


4.2 Terminals

Examples:

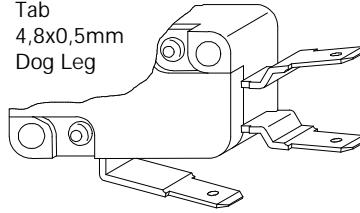
C3

Tab
2x2,8x0,8mm
Dog Leg



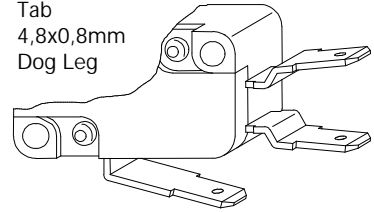
R3

Tab
4,8x0,5mm
Dog Leg



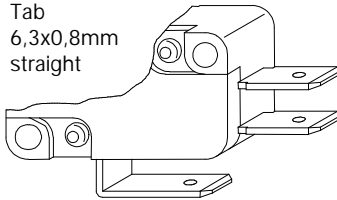
Q3

Tab
4,8x0,8mm
Dog Leg



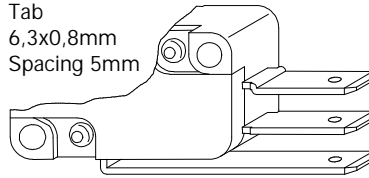
V1

Tab
6,3x0,8mm
straight



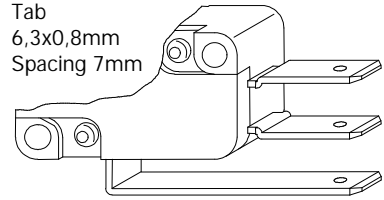
Y5

Tab
6,3x0,8mm
Spacing 5mm



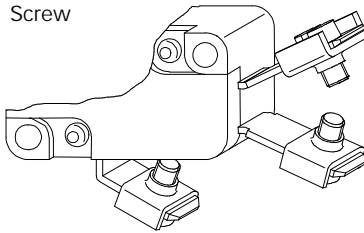
Z5

Tab
6,3x0,8mm
Spacing 7mm



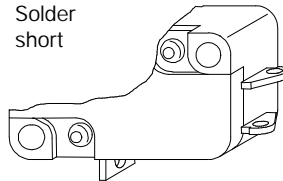
W9

Screw



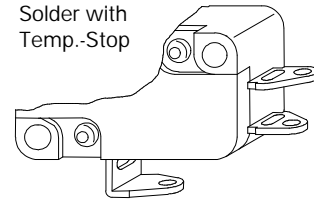
B8

Solder
short



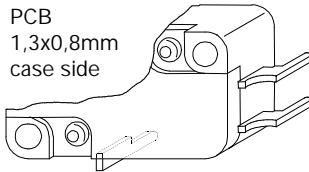
S1

Solder with
Temp.-Stop



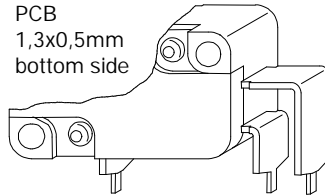
PA

PCB
1,3x0,8mm
case side



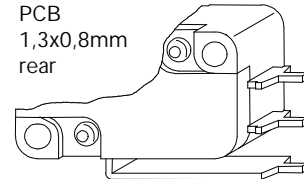
P4

PCB
1,3x0,5mm
bottom side



P5

PCB
1,3x0,8mm
rear



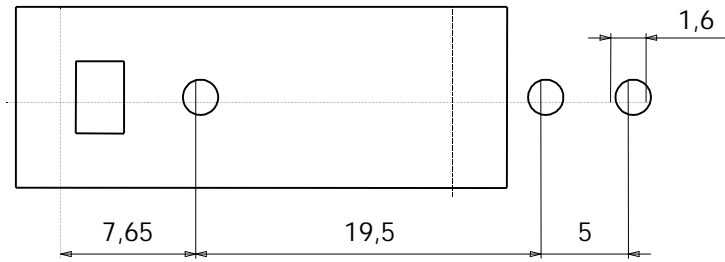
Tab terminals according to DIN 46244.

Connector housing for switches with Y5-terminals according to RAST 5 – Standard are available.

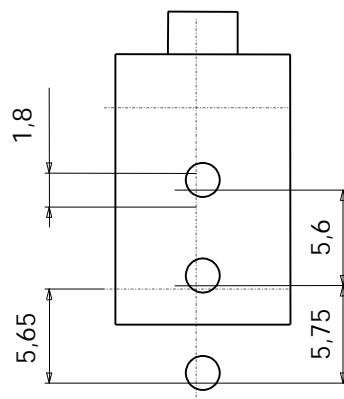
Other standard terminals see 3.3 Numbering matrix.

Combination of various terminals and special versions are available on request.

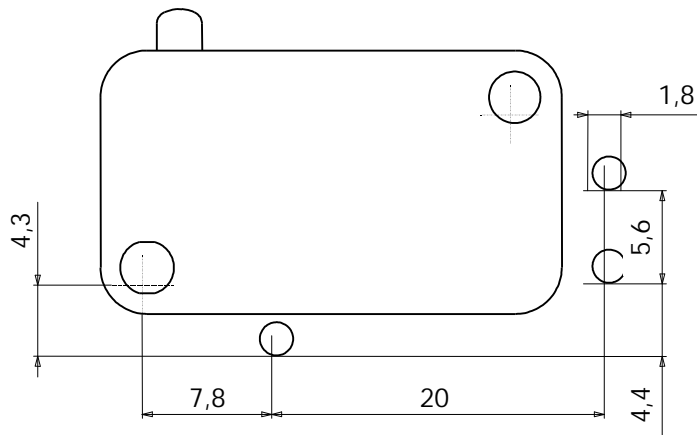
4.3 Drilling patterns for PCB terminals



PCB terminal 1,3x0,5mm, bottom side



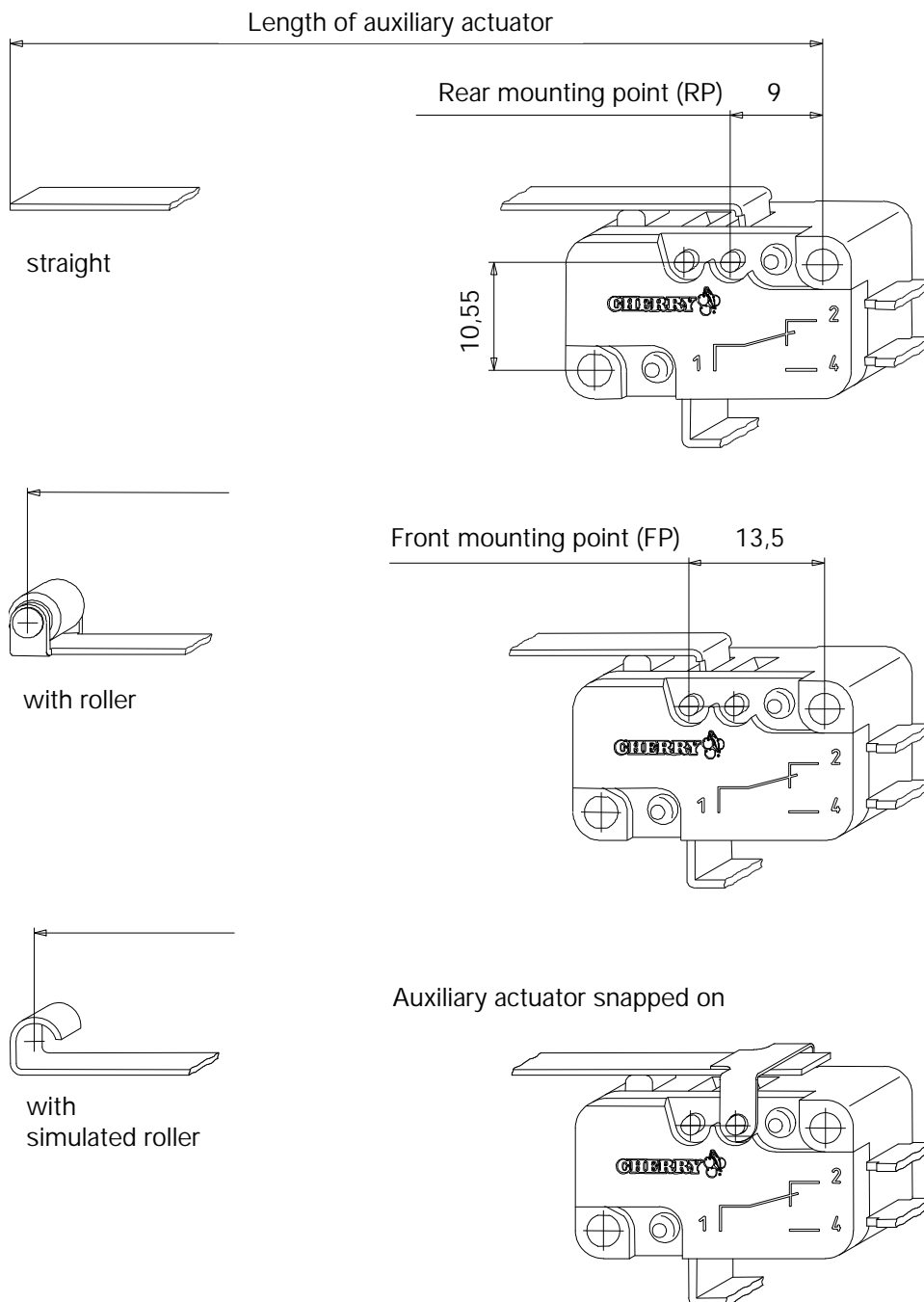
PCB terminal 1,3x0,8mm, rear



PCB terminal 1,3x0,8mm, case side

PCB terminal 1,3x0,8mm, cover side (mirror-inverted)

4.4 Auxiliary actuator



Straight auxiliary actuator are available with 5mm and 7mm width and in each length desired from 21,2mm (RP) to 113,5mm (FP). Other auxiliary actuator versions are available on request.

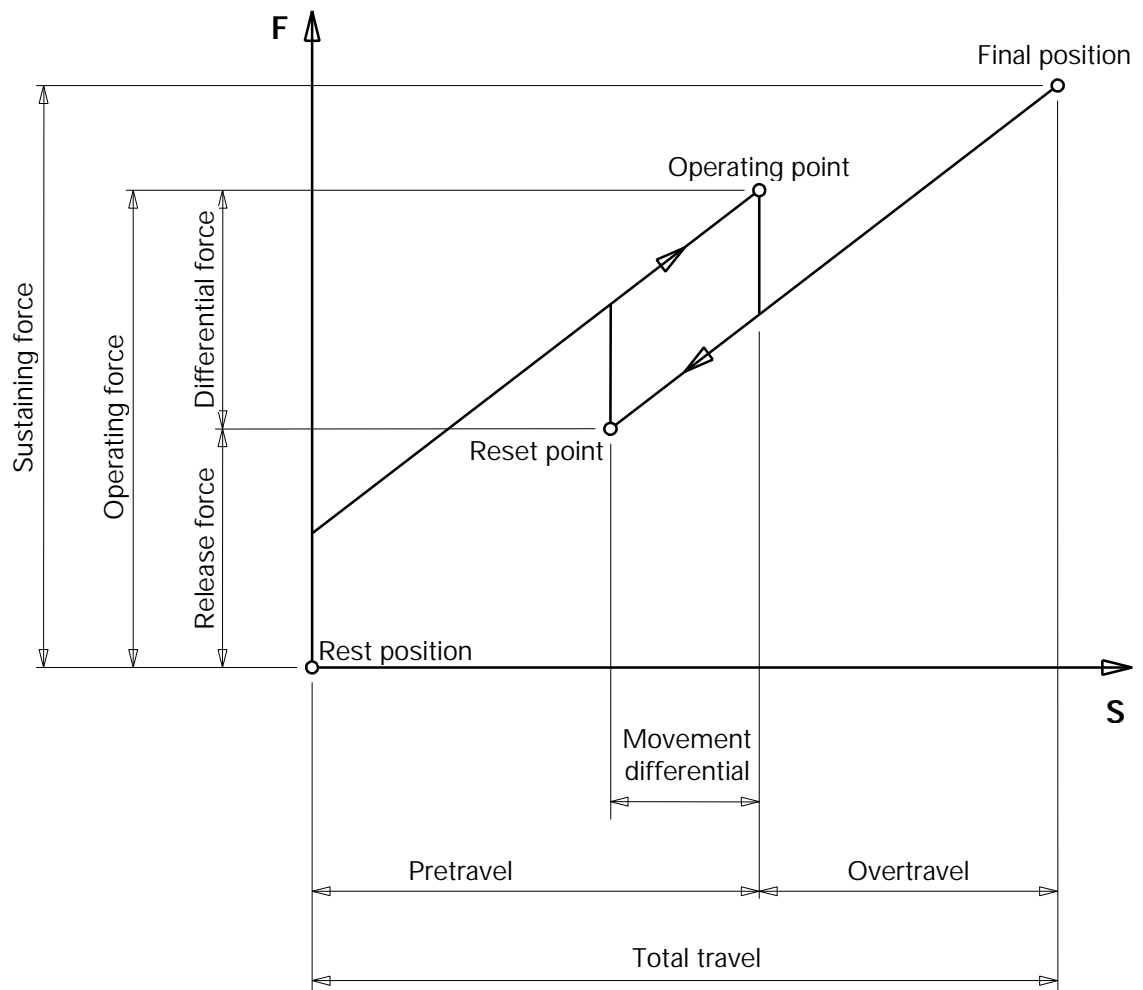
5 Mechanical and Electrical characteristics

5.1 Operating characteristics

Switch version	Operating Characteristic		without auxiliary actuator	with auxiliary actuator, straight					
				length A		length D		length L	
				rear mounting point	front mounting point	rear mounting point	front mounting point	rear mounting point	front mounting point
D41. bis	Rest position max.	mm	16,2	16,8	18,8	19,8	22,2	25,2	30,8
	Operating point	mm	14,7±0,5	15,2±0,5	15,2±0,8	15,2±1,2	15,2±1,6	15,2±3,2	15,2±4,2
D45.	Pretravel max.	mm	1,2	1,2	2,2	3,2	5,1	7,6	12,7
	Overtravel min.	mm	1,3	0,9	1,6	2,3	3,6	4,7	7,9
	Movement differential max.	mm	0,3	0,3	0,6	0,8	1,3	1,7	2,5
D41X	Operating force max.	cN	15	17	10	8	5	3,5	2
	Release force min.	cN	4	4	2	1,5	1	0,7	0,5
D41Y	Operating force max.	cN	75	85	50	40	25	17	10
	Release force min.	cN	22	22	12	10	6	4	3
D42X	Operating force max.	cN	15	17	10	8	5	3,5	2
	Release force min.	cN	4	4	2	1,5	1	0,7	0,5
D42Y	Operating force max.	cN	75	85	50	40	25	17	10
	Release force min.	cN	22	22	12	10	6	4	3
D43X	Operating force max.	cN	45	50	28	22	14	10	6
	Release force min.	cN	13	13	7	5	3	2	1,5
D43Y	Operating force max.	cN	170	190	110	86	50	40	25
	Release force min.	cN	45	45	25	20	11	8	5
D44X	Operating force max.	cN	75	85	50	40	25	17	10
	Release force min.	cN	22	22	10	8	6	3,5	2
D44Y	Operating force max.	cN	285	320	180	144	86	60	40
	Release force min.	cN	100	100	55	40	25	17	10
D45X	Operating force max.	cN	100	115	65	50	30	22	13
	Release force min.	cN	30	30	16	12	7	5	3
D45Y	Operating force max.	cN	400	440	256	200	120	90	56
	Release force min.	cN	140	140	75	60	35	25	15
D48X	Rest position max.	mm	16,2	16,8	18,8	19,8	22,2	25,2	30,8
	Operating point	mm	14,7±0,5	15,2±0,5	15,2±0,8	15,2±1,2	15,2±1,6	15,2±3,2	15,2±4,2
	Pretravel max.	mm	1,6	1,6	3,0	3,8	6,4	8,8	14,6
	Overtravel min.	mm	1,2	0,8	1,4	1,8	3,2	4,3	7,2
	Movement differential max.	mm	0,3	0,3	0,6	0,8	1,3	1,7	2,5
	Operating force max.	cN	150	180	100	75	45	35	20
	Release force min.	cN	60	55	30	22	13	10	6

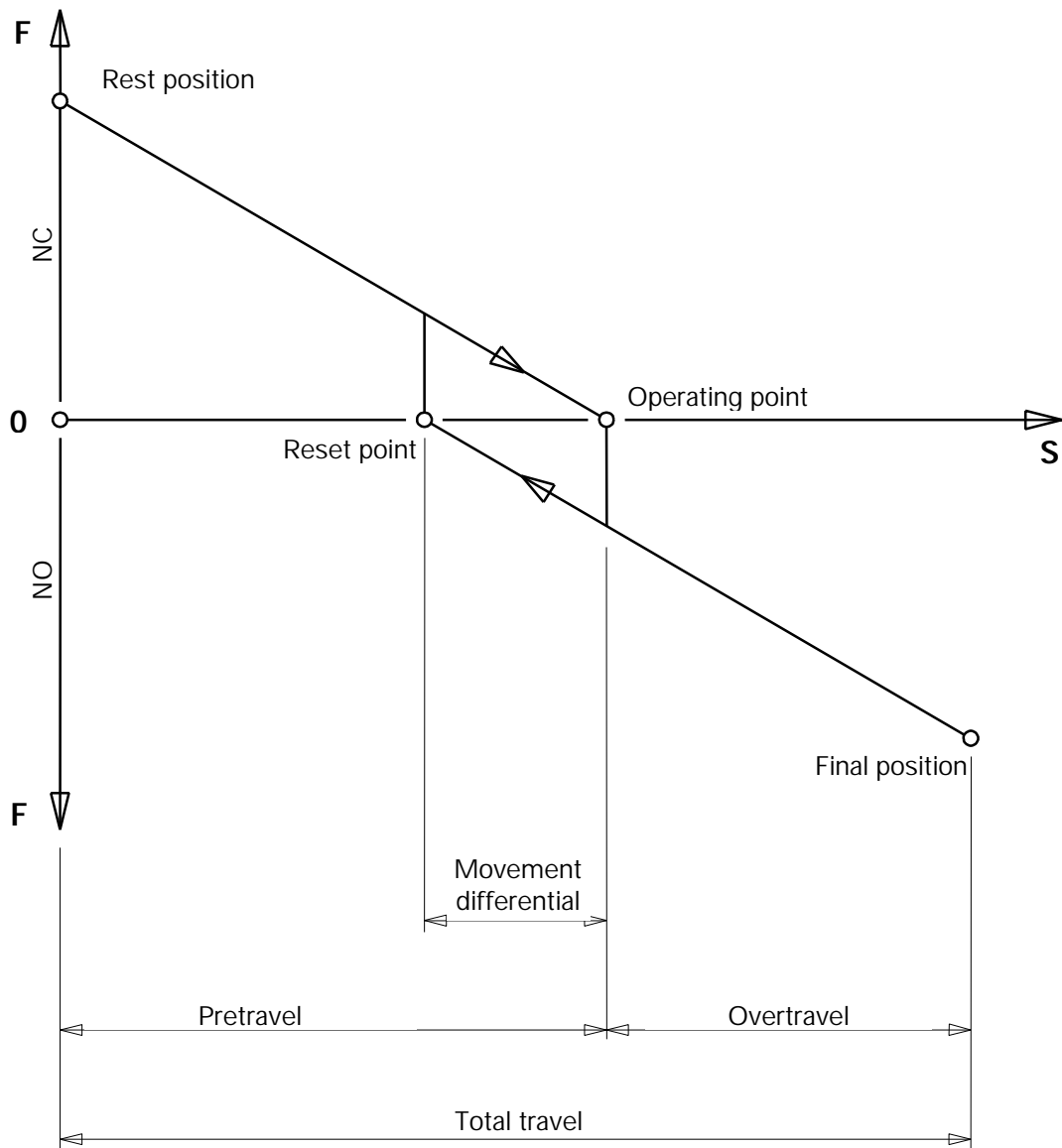
Length of auxiliary actuator see 3.3 Numbering matrix.

5.2 Operating force - travel diagram



The switch is actuated with a defined force over a specified travel. The applied operating force increases from the reset position to the operating point; it drops suddenly caused by the change-over of the snap-action mechanism to increase again up to the maximal force in the final position. During this indirect switch function the operation speed is kept extensively independent from the actuation speed.

5.3 Contact force - travel diagram



The maximal contact force in the rest position (at the NC contact) is reduced during the pretravel down to the value zero at the operating point. At this point the sudden change-over to the NO contact is made. During the reset travel the contact force increases up to the max. value in the final position.

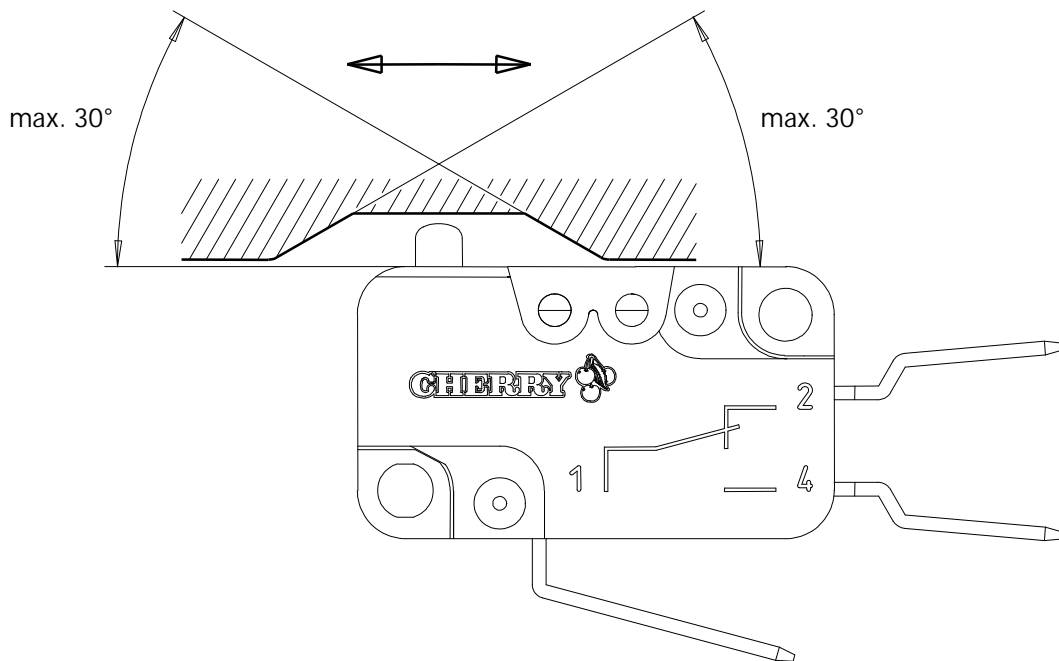
5.4 Actuation directions

5.4.1 Angled actuator

When operated by an angled actuator the angle of the lever in relation to the top of the switch housing should not exceed 30°.

Note:

In case of actuation in lateral direction the mechanical life depends on the material and the surface condition of the sliding part combination as well as on the operating speed. Application should be made upon agreement with Cherry.



5.4.2 Operating speed

min. 0,01 mm / s

max. 1 m / s

Applicable for switches without auxiliary actuator when operated in axial direction to the button.

Remark:

In case that the operating speed remains below the specified value the switch mechanism could be overheated and leads to a reduction of the electrical switch rating.

If the operating speed is exceeded, the mechanical life is reduced.

5.4.3 Overtravel

The actuator should travel well beyond the switching point for at least 50% of the available overtravel to make absolutely sure that the electrical rated load is switched.

Effects of a reduced overtravel:

- Reduction of contact force and functional safety
- Danger of contact welding
- Overheating of switch mechanism possible

Remark:

The max. overtravel is limited by the upper edge of the switch case. It is not permitted to apply a supporting force.

5.4.4 Rest position

The actuator should not be pre-stressed in its rest position. Effects of pre-stress see 5.4.3 Overtravel.

5.5 Mechanical life

Button material	Switch type										
	D41X	D41Y	D42X	D42Y	D43X	D43Y	D44X	D44Y	D45X	D45Y	D48X
POM	1x10 ⁷	1x10 ⁷	1x10 ⁷	1x10 ⁷	1x10 ⁷	5x10 ⁶	1x10 ⁷	1x10 ⁶	1x10 ⁷	2x10 ⁵	3x10 ⁶
PET	1x10 ⁶	1x10 ⁶	1x10 ⁶	1x10 ⁶	5x10 ⁵	25x10 ⁴	25x10 ⁴	1x10 ⁵	25x10 ⁴	1x10 ⁵	25x10 ⁴

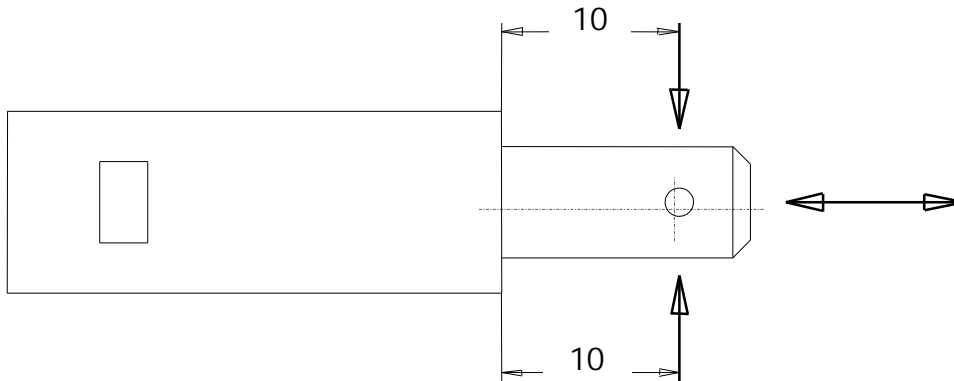
Remark:

The above table applies to switches without auxiliary actuator and for sinusoidal operation in axial direction to the button with 100% overtravel.

Further details concerning mechanical life are given on request.

5.6 Allowed mechanical load applied to the terminals

Permissible push- and pull forces to connect or disconnect the receptacles according to DIN 46247 in axial direction: max. 100 N.
 Allowed lateral mechanical load applied to terminals: max. 25 N.



Remark:

Soldering connections of PCB terminals have to resist the mechanical and electrical load over the whole service life. If necessary, the switch must be provided with additional fixing means.

The switch design does not allow a continuous force being applied to the terminals.

5.7 Mounting

Max. tightening torque value is 60 Ncm when using M3 screws with washer.

In case that the switch is mounted with other screw types the tightening torque has to be adjusted in a suitable way.

The fastening screws shall be secured against self-slackening.

In order to adhere to the required creepage distances and clearances an insulating plate must be inserted between the switch and a metal mounting position.

5.8 Electrical data

Switch type	EN 61058-1				UL 1054			
	Electrical rating	Temperature rating Operating cycles			Electrical rating	Temperature rating Operating cycles		
D41X	0,1(0,05)A 250V~	40T85 50.000	40T125 50.000	40T150 50.000	0,1A 125/250VAC	85°C 6.000	125°C 6.000	150°C 6.000
D41Y	0,1(0,05)A 250V~	40T85 50.000	40T125 50.000		0,1A 125/250VAC	85°C 6.000	125°C 6.000	
D42X	3(1)A 250V~	40T85 50.000	40T125 50.000	40T150 50.000	3A 125/250VAC 1/10HP 250VAC	85°C 6.000	125°C 6.000	150°C 6.000
D42Y	3(1)A 250V~	40T85 50.000	40T125 50.000		3A 125/250VAC 1/10HP 250VAC	85°C 6.000	125°C 6.000	
D43X	6(2)A 250V~	40T85 50.000	40T125 50.000	40T150 50.000	5A, 1/4HP 125/250VAC	85°C 6.000	125°C 6.000	150°C 6.000
D43Y	6(2)A 250V~	40T85 50.000	40T125 50.000		5A, 1/4HP 125/250VAC	85°C 6.000	125°C 6.000	
D44X	10(3)A 250V~	40T85 50.000	40T125 50.000	40T150 50.000	10A, 1/2HP 125/250VAC	85°C 6.000	125°C 6.000	150°C 6.000
D44Y	10(3)A 250V~	40T85 50.000	40T125 50.000		10A, 1/2HP 125/250VAC	85°C 6.000	125°C 6.000	
D45X	16(4)A 250V~	40T85 50.000	40T125 10.000	40T150 10.000	15A, 1/2HP 125/250VAC	85°C 6.000	125°C 6.000	150°C 6.000
	10(3)A 250V~		40T125 50.000	40T150 50.000				
D45Y	16(4)A 250V~	40T85 50.000	40T125 10.000		15A, 1/2HP 125/250VAC	85°C 6.000	125°C 6.000	
	10(3)A 400V~	40T85 50.000	40T125 50.000					
D48X	21(8)A 250V~	40T85 10.000			21A, 2HP, 250VAC 1HP, 125VAC	85°C 6.000		

Further information concerning electrical rating, electrical life, DC current ratings and special versions for DC applications on request.
Special versions with 100.000 operating cycles according to UL 1054 on request.

5.8.1 Operating load

Switch version D41. : min. 0,001A / 5V
D42. - D48. : min. 0,1A / 12V

Information concerning max. operating load exceeding the rated load due to current peaks on request.

5.8.2 Contact resistance

Switch type D41. : R_D max. 50 m Ω , tested at 0,01A / 3V
D42. - D48. : R_D max. 100 m Ω , tested at 0,1A / 10V

Values refer to switches in new condition, at the NC contact in rest position, at the NO contact in final position.

5.8.3 Changeover time

max. 20 ms at $v = 0,6\text{mm} / \text{s}$

Values refer to switches in new condition.

5.8.4 Bounce

max. 10 ms at $v = 0,6\text{mm} / \text{s}$

Values refer to switches in new condition.

5.8.5 Switching rate

Applicable for rated current up to 10A : max. 15 operating cycles / min
Applicable for rated current up to 16A : max. 7,5 operating cycles / min
Without load (mechanical): max. 400 operating cycles / min

5.8.6 Insulation resistance

Between live components and ground: min. 10 M Ω
Between open contacts: min. 10 M Ω

Values refer to switches in new condition, measurement with 500 VDC / 1 min.

5.8.7 Electrical strength

Between live components and ground: 1250 VAC
Between open contacts: 750 VAC

Values refer to switches in new condition at a rated voltage of 250VAC.

6 Environmental Requirements

6.1 Type of Protection

Protection level according to EN 60529

Switch interior: IP 40

Terminals: IP 00

6.2 Ambient Temperature

Ambient temperature ranges see 5.8: Electrical Data

6.3 Vibration resistance

Vibration, sinusoidal according to EN 60068-2-6

Acceleration: 5 g

Frequency range: 10 to 500 Hz

Values apply to switches without auxiliary actuator.

6.4 Shock resistance

Shock test, half-sinusoidal according to EN 60068-2-27

Acceleration: 20 g

Shock duration: 6 ms

Values apply to switches without auxiliary actuator.

7 Production, storage, packaging, transport and processing

D4 switches are produced in accordance with the following Cherry-internal regulations:

- Work instruction FAW 288, 446, 447, 448, 485, 722
- Test instruction PAW 304
- Test guide snap action switches / special switches, general
- Packaging instruction VAW 51, 52, 53, 248

Remark:

It is not acceptable to store the switches in a humid environment, near aggressive media or at high temperatures. The switches shall be stored and handled in their original packaging.

7.1 Resistance against media

Corrosive gases and other substances affecting the switches, as e.g. grease and oil shall be avoided because of their detrimental influence on the operation safety and service life!

In case that a special application requires the use of aggressive substances the customer should consult Cherry!

Grease and lubricants based on PAO or containing silicone shall be kept apart from the switch. On principle grease and lubricants based on PAG should be preferred, however their influence on the switches should be determined through tests.

Substances containing silicone shall be excluded from the close environment of the switches.

7.2 Soldering recommendation

Soldering device: Temperature adjustable, 50 – 80 VA
 Soldering temperature: 230° - 250°C at the terminals
 Soldering duration: 2 to 4 seconds
 Solder material: Tube solder wire L-Sn60PbCu2 / F-SW 26
 diameter 0,75 mm, Fg 1,4%

Remark:

Avoid to apply mechanical force to the terminals during soldering procedure.
 Use exhausting device for solder vapour.

8 Materials

Part description	Switch type	Material
Case	D41. – D48.	PET
Cover	D41. – D48.	PET
Button	D41. – D48. (max. 85°C)	POM
	D41. – D45. (max. 150°C)	PET
Terminal COM	D41. – D48.	CuZn37 silver plated
Terminal NC/NO	D41. – D45.	CuZn37
	D48X	Cu
Blade	D41. – D43.	CuZn30 silver plated
	D44. – D48.	CuCoBe silver plated
Contacts	D41.	AuAg25Pt6
	D42.	AgNi0,15
	D43. – D48.	AgCdO10
Internal actuator	D41X – D48X	St3 nickel plated
Spring	D41. – D48.	X12CrNi177
Auxiliary actuator	D41. – D48.	St3 nickel plated X5CrNi1810 AlMg3

8.1 Flammability

The material PET we use fulfil the requirements for resistance to fire and tracking as follows:

- Flammability according to UL 94 V-0
- Proof tracking index PTI 300 according to IEC 60112
- Glow wire test at 850°C according to EN 60695-2-11
- Glow wire test at 750°C without ignition according to IEC 60335-1

8.2 Hazardous substances

The materials used are in accordance with the VDA-List of declarable materials.

9 Approvals

The D4 miniature switch series has been tested and approved according to EN 61058-1 and UL 1054.

- Approval ENEC-VDE (Europe)



- Approval UL (Canada and USA)



10 Applicable documents

The following documents have validity in addition to this specification:

- Cherry drawings for D4 miniature switch
- DIN 41635 : 1981
- DIN 46244 : 1980
- DIN 46247 : 1973
- EN 60068-1 : 1994
- EN 60068-2-6 : 1994
- EN 60068-2-27 : 1995
- EN 60529 : 2000
- EN 60617 : 1997
- EN 60695-2-11 : 2001
- EN 61058-1 : 1993
- IEC 60112 : 2003
- IEC 60335-1 : 2002
- RAST 5 – Standard : 1997
- UL 94 : 5 Ed. rev. May 2001
- UL 1054 : 5 Ed. rev. June 2002
- VDA 232-101 : 2002