MILACRON®

Collapsible Cores

DME

Every step of the way

Info CCM-CC

General description of the Collapsible Cores

It is over 30 years since DME first introduced the Collapsible Core and today it still continues to be a major influence for molding plastic parts requiring internal threads, undercuts, cut-outs etc. During this time a lot of technical knowledge and experience has been gained from many applications tackled, some of which have been very complicated. This "Know how" has been constantly passed on to the user, either through new developments, application improvements or suggestions for new applications. One such development is the new range smaller diameters which complete the series of Collapsible Cores. The Collapsible Cores now range from 18 mm to 107 mm, for the outer diameters with the corresponding inner diameter ranging from 16 mm to 85 mm. The effective collapse ranges from 1.1 mm to 4,2 mm per side at the tip of the Core, depending on the diameter of the Core.

Operation

After cooling, the mold opens and the ejector plate assembly moves forward as far as the stop. This causes the core sleeve to move away from the centre pin and the positive collapsed sleeve to engage, which ensures that all segments have collapsed. However, the molded part remains or hangs until the stripper plate is moved forward to eject the components. This is usually carried out by the activation of two double acting air cylinders mounted on the ejector plates and connected to the stripper plate on the outside of the mold. The stripper plate is then retracted using the two air cylinders before the mold is closed. When closing the mold, one has to ensure that the ejector plates are returned before the mold is fully closed. This can be achieved by the use of early ejector returns. The core sleeve is returned to the molding position thus preventing damage to the Collapsible Cores. When the mold is fully closed the next cycle can begin. When using Collapsible Cores the designer has a product which offers many opportunities for producing many variations of molded caps. The result is a mold which functions reliably and economically irrespective of whether it concerns a single or multiple cavity mold. Parts with internal protrusions, dimples, interrupted threads and cut-outs can be economically produced on a high or low volume basis. It should be noted that due to the design of the Mini Collapsible Core only interrupted threads and undercuts can be produced. The interruptions consist of three small slots with width "J" (See table), but in most cases this does not imply any technical disadvantages.

Design Procedure

The following steps are used to determine if a part can be molded on the Mini or Standard Collapsible Core:

a) Calculate the expected actual shrinkage "S" = part Ø x shrinkage (%) "S1" = part length x shrinkage (%)

b) Determine that the part minor diameter "A" is not less than "A min" (See table and Fig 1)

c) Determine that the part major diameter "B" is not greater than "B max" (See table and Fig 1)

d) Determine that thread depth or part undercut at "L" does not exceed the calculated dimension "C" (see Table and Fig.1). The collapse available decreases from the front of the core at a rate of 0,02 mm/mm. When the amount of collapse "C" of the Mini or Standard Collapsible Cores is insufficient, Collapsible Cores of the same size but with a greater collapse can be obtained.

Type	CK Max.
CCM-0001	1.45 mm/side
CCM-0002	1.60 mm/side
CCM-0003	1.80 mm/side
CC 125 PC	0.80 mm/side
CC 150 PC	1.07 mm/side
CC 175 PC	1.20 mm/side
CC 250 PC	1.20 mm/side

Type	CK Max.
CC 252 PC	1.60 mm/side
CC 352 PC	2.10 mm/side
CC 402 PC	2.65 mm/side
CC 502 PC	3.20 mm/side
CC 602 PC	3.75 mm/side
CC 652 PC	4.06 mm/side
CC 702 PC	4.32 mm/side

CK = Collapse per side at top of core.

e) Determine that part depth "D" (Fig 1) does not exceed the value "D" given in the table. Dimension "K min" of the table must be equal to or larger than "K min".

Material and hardness

a) The centre pin is manufactured from high quality alloy steel 1.2436, hardened to 60-65 HRC. Centre pins for Standard as well as for Mini Collapsible Cores are fitted to a specific core and cannot be interchanged. This is due to the centre pin and core sleeve being assembled and ground together.

b) Core sleeves are manufactured in a 1.2363 steel (AISI 01) and hardened to 55-60 HRC. All centre pins and core sleeves carry a serial number. Always verify the serial number prior to grinding or final assembly.

c) The positive collapse sleeve is manufactured in tool steel and hardened to 55 ± 5 HRC. It is designed to function when the Collapsible Core fails to collapse independently upon withdrawal of the centre pin. Its aim is an additional and necessary safety factor.

What materials can be molded?

All commonly used thermoplastic molding resins. For many years filled and non-filled molding resins have been successfully molded. Special requirements have to be taken into consideration when PVC is processed. When using the Mini or Standard Collapsible Cores for processing this material it is recommended you contact **DME**.

Part design - special requirements

For successful operation the design of the part must fulfil the following requirements:

a) In contrast with the Standard Collapsible Core it is not possible to mold parts with full threads with the Mini Collapsible Core. The three remaining "marks" on the part result from the three interrupted areas with width "J" of the non-collapsing centre pin blades. Make sure that the top of the centre pin protrudes beyond the top of the core sleeve.

b) The centre pin must protrude beyond the core face by at least the distance "F". Protrusions down to "F min" are acceptable but "F max" is recommended. For "F min" and "F max" see Table or Collapsible Core dimensions leaflet. Radius "R" is most important. For "R min" and "R max" see Collapsible Core dimension drawing.

c) There must be no undercuts on the face of the core segments. This will prevent the Collapsible Core from functioning.

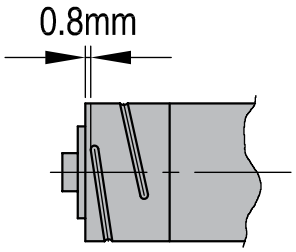
d) Undercuts on the face of the pin must not interfere with full radial movement of the core. They must be located either forward of the core face or within a diameter smaller than "G" (see Table, Fig 3; max 4 mm - see Collapsible Core dimension drawing). In no case should the undercuts be so deep that they come close to the cooling lines in the centre pin. For special requirements please contact **DME**.

e) The core face must have a draft of at least 3° starting no further than 0.8 mm from the top of the pin. A greater draft is desirable when "B" is near "B max" (ex. 4-5°).

f) All undercuts should be drafted. A minimum draft of 5° is required (see Table, fig 3), more is recommended. Interrupted undercuts also require a side draft of at last 5°.

g) Means must be provided for carrying the molded part off of the collapsed core at the completion of the ejection stroke. This is normally done by providing a ring projection (0.25 x 0.25 mm) on the face of the stripper stroke. The part must not drag over the core (see detail Y on Collapsible Core dimensions leaflet).

h) As in conventional practice, sharp interior corners must be avoided to prevent stress concentration in the steel. Never permit a ground thread to run out through the face of the core. This leaves a knife edge of steel that will break off in time.



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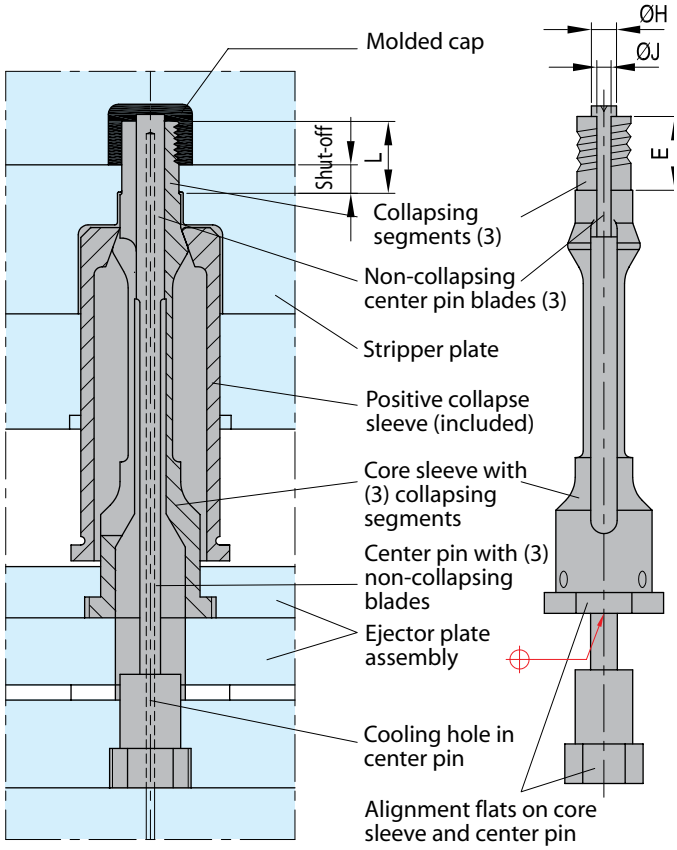
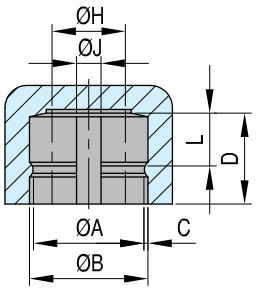
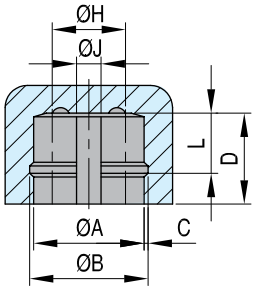
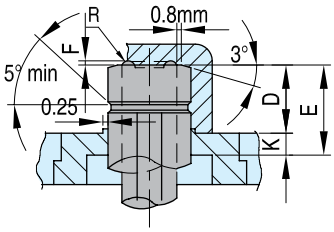
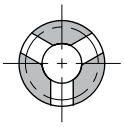
Collapsible mini-cores

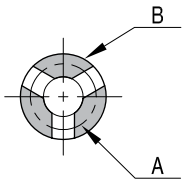


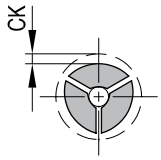












REF	A. Part Minor Ø (min.)	B. Part Major Ø (max.)	C. Maximum part undercut at L	D. Maximum part depth	E. Length of fitted surface on core	F. Pin protrusion, min.	G. Inside diameter collapsed core nom	H. Pin diameter at face (nominal)	K. Stripper bushing shut-off	J. Width of non-collapsing	R. Pin tip radius	S. Material shrinkage
CCM 0001	10,80-S	16,38-S	1,30-(0,02L+0,5S)	21,60-S1-K	21,60	0,4 (0,8 max)	2,30	7,60	4,00	4	0,20	S= Shrinkage factor (%) x Part diameter (mm) S1= Shrinkage factor (%) x Part length (mm)
CCM 0002	14,22-S	20,45-S	1,45-(0,02L+0,5S)	21,60-S1-K	21,60	0,4 (0,8 max)	4,60	10,70	4,83	4	0,20	
CCM 0003	18,03-S	24,51-S	1,50-(0,02L+0,5S)	25,40-S1-K	25,40	0,4 (0,8 max)	7,90	14,20	5,08	4	0,20	

Collapsible cores

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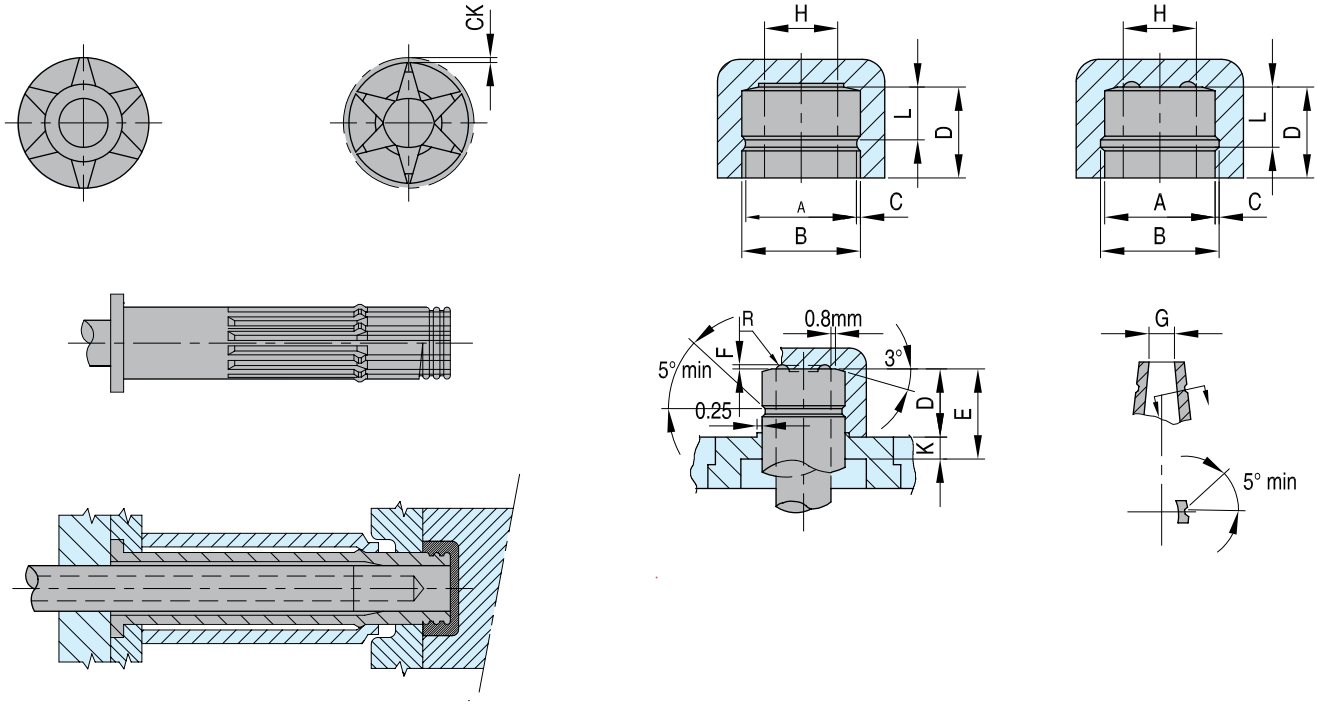

REF	A. Part Minor Ø (min.)	B. Part Major Ø (max.)	C. Maximum part under-cut at L	D. Max. part depth	E Max. molded length	F. Pin protru-sion, min.	G. Inside diameter collapsed core nom	H. Pin diam-eter at face (nominal)	K. Stripper bushing shut-off	R. Pin tip radius	S. Material shrinkage
CC 125 PC	15,75-S	18,29-S	0,69 - (0,02L+0,5S)	E-K	20,30	0,4	5,3	12,45	4	0,20-0,25	S= Shrinkage factor (%) x Part diam-eter (mm) S1= Shrinkage factor (%) x Part length (mm)
CC 150 PC	17,78-S	21,59-S	0,94 - (0,02L+0,5S)	E-K	25,40	0,4	5,8	14,73	4	0,20-0,25	
CC 175 PC	19,30-S	24,64-S	1,09 - (0,02L+0,5S)	E-K	25,40	0,4	7,4	16,26	4	0,20-0,25	
CC 250 PC	23,10-S	32,25-S	1,09 - (0,02L+0,5S)	E-K	29,21	0,4 (1,9 max)	10,2	19,9	4	0,20-0,25	
CC 252 PC	25,65-S	35,30-S	1,40 - (0,02L+0,5S)	E-K	29,21	0,4 (1,9 max)	11,9	22,5	4	0,25-0,30	
CC 352 PC	32,26-S	44,19-S	1,73 - (0,02L+0,5S)	E-K	35,56	0,5 (1,9 max)	15,0	28,1	4	0,25-0,35	
CC 402 PC	40,46-S	55,42-S	2,29 - (0,02+0,5S)	E-K	43,18	0,8 (1,9 max)	18,4	35,25	5	0,30-0,35	
CC 502 PC	52,32-S	71,12-S	2,92 - (0,02L+0,5S)	E-K	48,26	0,9 (2 max)	24,0	44,45	6 (min.4)	0,35-0,40	
CC 602 PC	66,29-S	89,78-S	3,55 - (0,02L+0,5S)	E-K	60,96	1,1 (2,0 max)	30,5	55,25	6,5	0,50-0,60	
CC 652 PC	73,41-S	96,52-S	3,81 - (0,02L+0,5S)	E-K	60,96	1,5	34,3	62,23	7	0,60-0,70	
CC 702 PC	85,09-S	107,31-S	4,19 - (0,02L+0,5S)	E-K	60,96	1,5	41,9	73,02	7	0,60-0,70	

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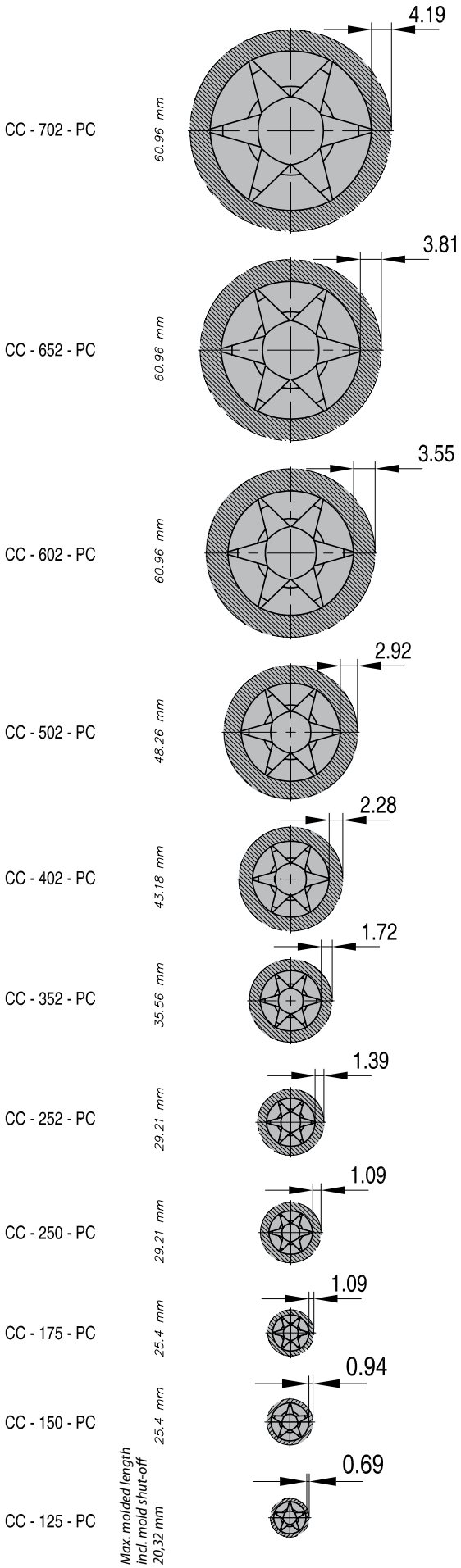
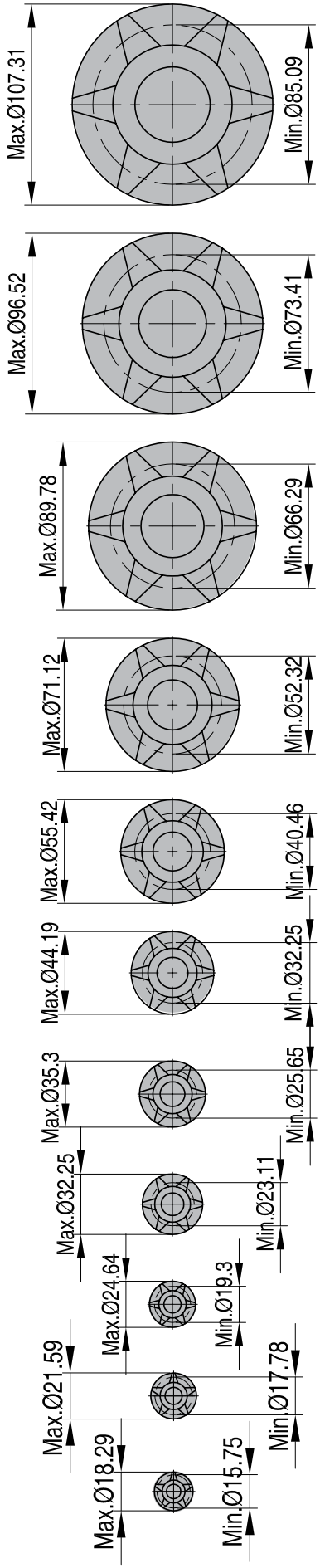
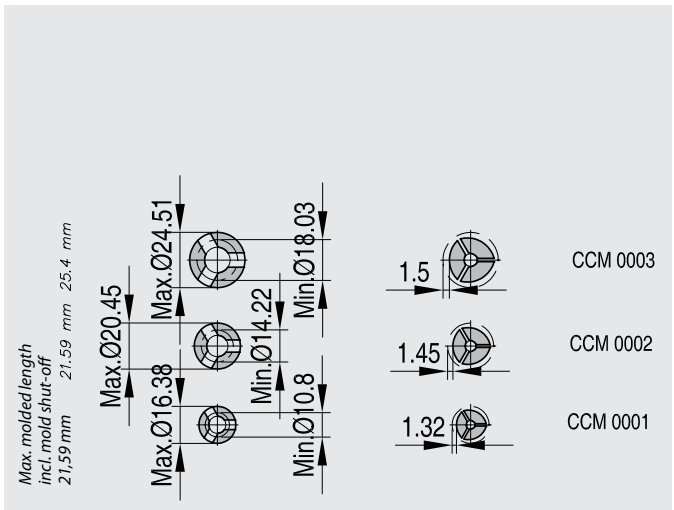
Collapsible cores




Max.Ø107.31
Min.Ø85.09
Max.Ø96.52
Min.Ø73.41
Max.Ø89.78
Min.Ø66.29
Max.Ø71.12
Min.Ø52.32
Max.Ø55.42
Min.Ø40.46
Max.Ø44.19
Min.Ø32.25
Max.Ø35.3
Min.Ø25.65
Max.Ø32.25
Min.Ø23.11
Max.Ø24.64
Min.Ø19.3
Max.Ø21.59
Min.Ø17.78
Max.Ø18.29
Min.Ø15.75


Max. molded length
incl. mold shut-off
21,59 mm 21.59 mm 25.4 mm
Max.Ø20.45
Max.Ø24.51
Min.Ø14.22
Min.Ø18.03
Max.Ø16.38
Min.Ø10.8
1.5
1.45
1.32
CCM 0003
CCM 0002
CCM 0001