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Second edition
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Hollow taper interface with flange contact surface —

Part 1: Shanks of types A, AB, C, CB and EB

Interfaces à cône creux-face —

Partie 1: Queues de type A, AB, C, CB et EB

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by the Technical Committee ISO/TC 29, *Small tools*, Subcommittee SC 9, *Tools with defined cutting edges, holding tools, cutting items, adaptive items and interfaces*.

This second edition cancels and replaces the first edition (ISO 12164-1:2001), which has been technically revised.

The main changes are as follows:

— new hollow taper shank types added;

— new hollow taper shank of type AB has a peripherally grooved flange collar for automatic tool change, dynamically balanced;

— new hollow taper shank of type CB for manual tool change, dynamically balanced;

— new hollow taper shank of type EB has a peripherally grooved flange collar for automatic tool change, symmetrically designed;

— the balancing quality has been improved.

A list of all parts of the ISO 12164 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Hollow taper interface with flange contact surface —

Part 1:
Shanks of types A, AB, C, CB and EB

1 Scope

This document specifies the dimensions of hollow taper shanks with flange contact surface (HSK). These shanks are the male part of the interface to the machine tools (e. g. milling/drilling, turning and grinding machines).

This document specifies five types of shanks:

— types A, AB and EB have a peripherally grooved flange for automatic tool change;

— types C and CB have a flange without peripheral groove and can only be changed manually.

HSK types A and AB can also be changed manually via radial access bore holes in the hollow shank tapers.

This document provides information for dynamically balanced HSK-AB and HSK-CB shanks balancing according to ISO 16084.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2768-1, *General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Hollow taper shanks, types and dimensions

4.1 General

Dimensions for all parameters of all types and sizes of HSK hollow taper shanks are provided in 4.5.

Parameters of the types C, CB and EB, not specified in 4.3 and 4.4, shall be taken from 4.5. Details not specified in 4.5 shall be chosen expediently.

Only the HSK types AB and CB have balancing recesses inside the low HSK taper groove and left and right of it (see Figures 1 and 11). They lead, together with the corresponding balancing measures of

4.2.2 at the HSK shank flange, to dynamically balanced HSK shank of types AB and CB without changing their functionality.

Preferred zones for further balancing measures are specified in Clause 5.

For clamping forces for HSK shanks of types A, AB, C, CB and EB, see in Annex A.

For hollow taper shanks of types C and CB with medium - transfer unit, see Annex B.

For an overview of all different types of shanks, see Annex C.

Tolerances of form, orientation, location and run-out correspond to ISO 1101. Dimensions and tolerances of cones are in according to ISO 3040. Tolerances not specified shall be of tolerance class "m" in accordance with ISO 2768-1.

4.2 Hollow taper shanks of types A and AB

4.2.1 General

Figure 1 provides the parameters of the types A and AB, as well as common dimensions of all hollow taper shank types with flange contact surface (also called “HSK” or “HSK shank” in this document).

The HSK of type AB is the dynamically balanced version of the hollow taper shank for automatic tool change.

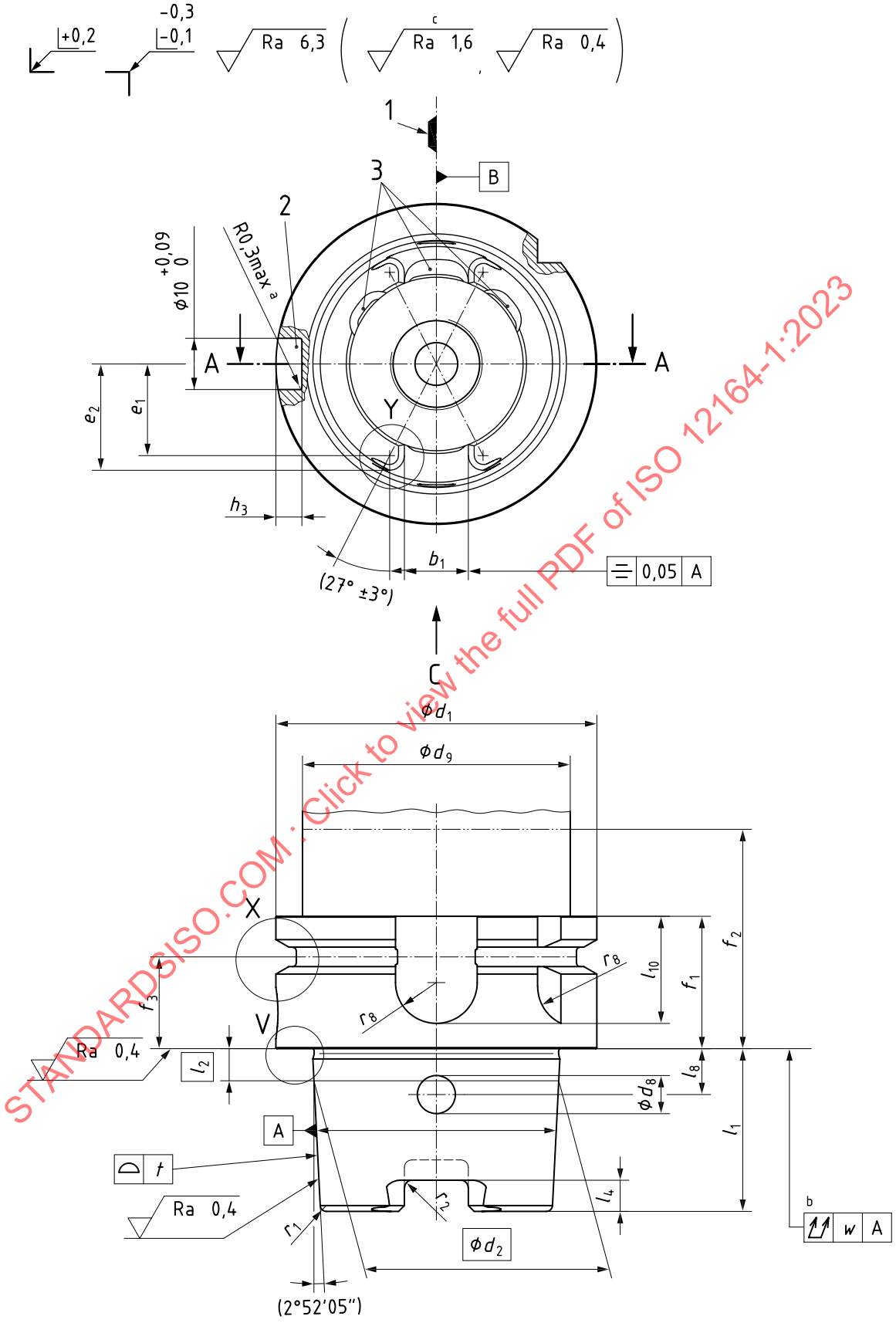
Many products with HSK-shanks, e. g. adapters and/or cutting tools, have symmetrical front parts of short length and/or small diameters. They can only be balanced dynamically, i.e. in two balancing planes, by applying the measures of the HSK-AB as described in this document. There are either no other areas available for sufficient and sensible mass compensation, or restrictions of tool handling mechanisms of existing machine tools make alternative measures impossible.

All parameters of Figure 1 but the recesses (#3) also apply to HSK of type A and can be taken from Table 1. Figure 1 and Table 1 show the general parameters and values of all HSK-AB and -A sizes.

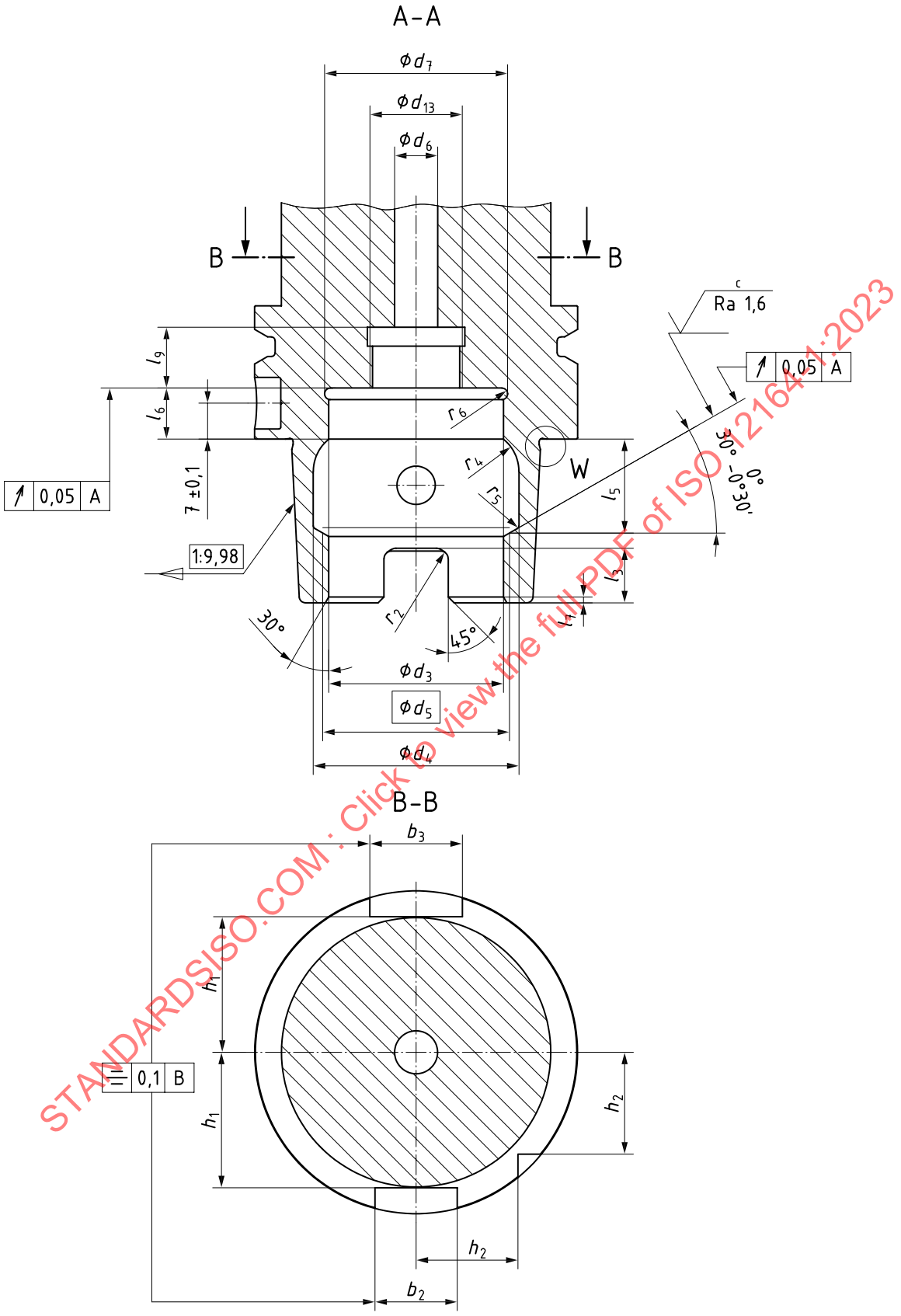
The three balancing recesses at the low taper groove inside diameter d_3 (Figure 1, view Z and cross section C-C), as well as the balancing bore holes at the HSK shank flange in 4.2.2 only apply to the dynamically balanced HSK-AB. All radial bore holes (see Figure 1) shall be deburred.

In case of choosing any different geometry of the balancing bore holes at the shank flange the same unbalance at the same axial position of the centre of gravity shall be removed.

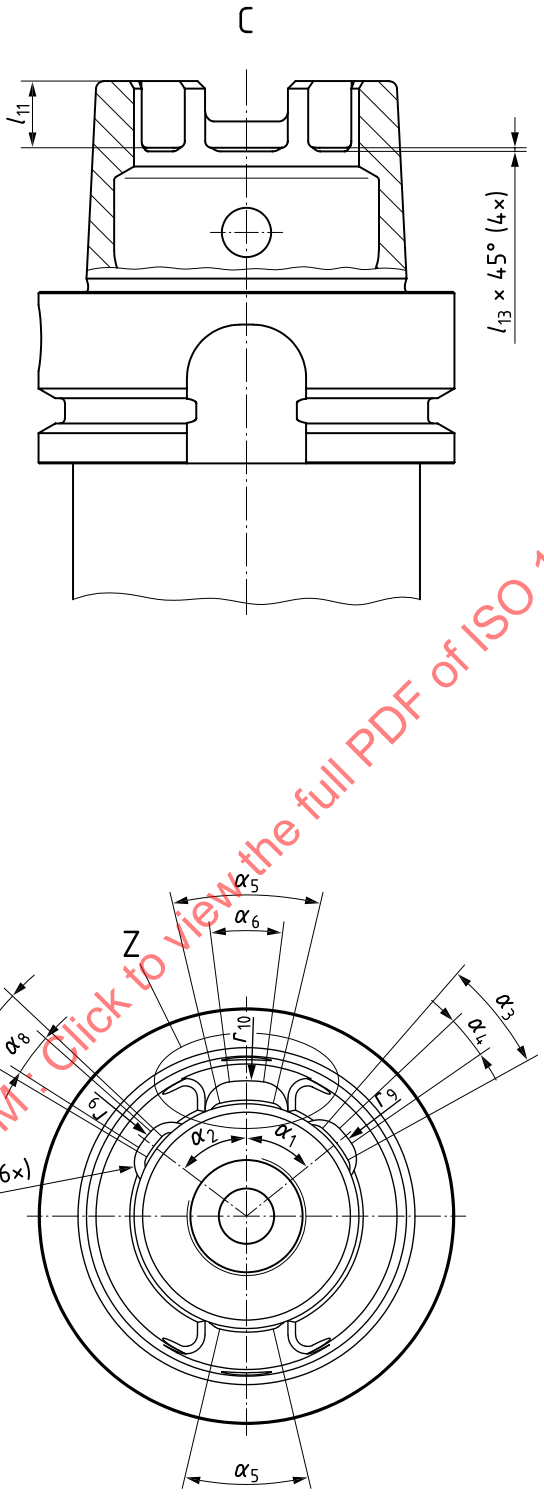
NOTE The positions of balancing bore holes at the HSK shank flange take mechanical restrictions of known automatic tool changing systems into account.



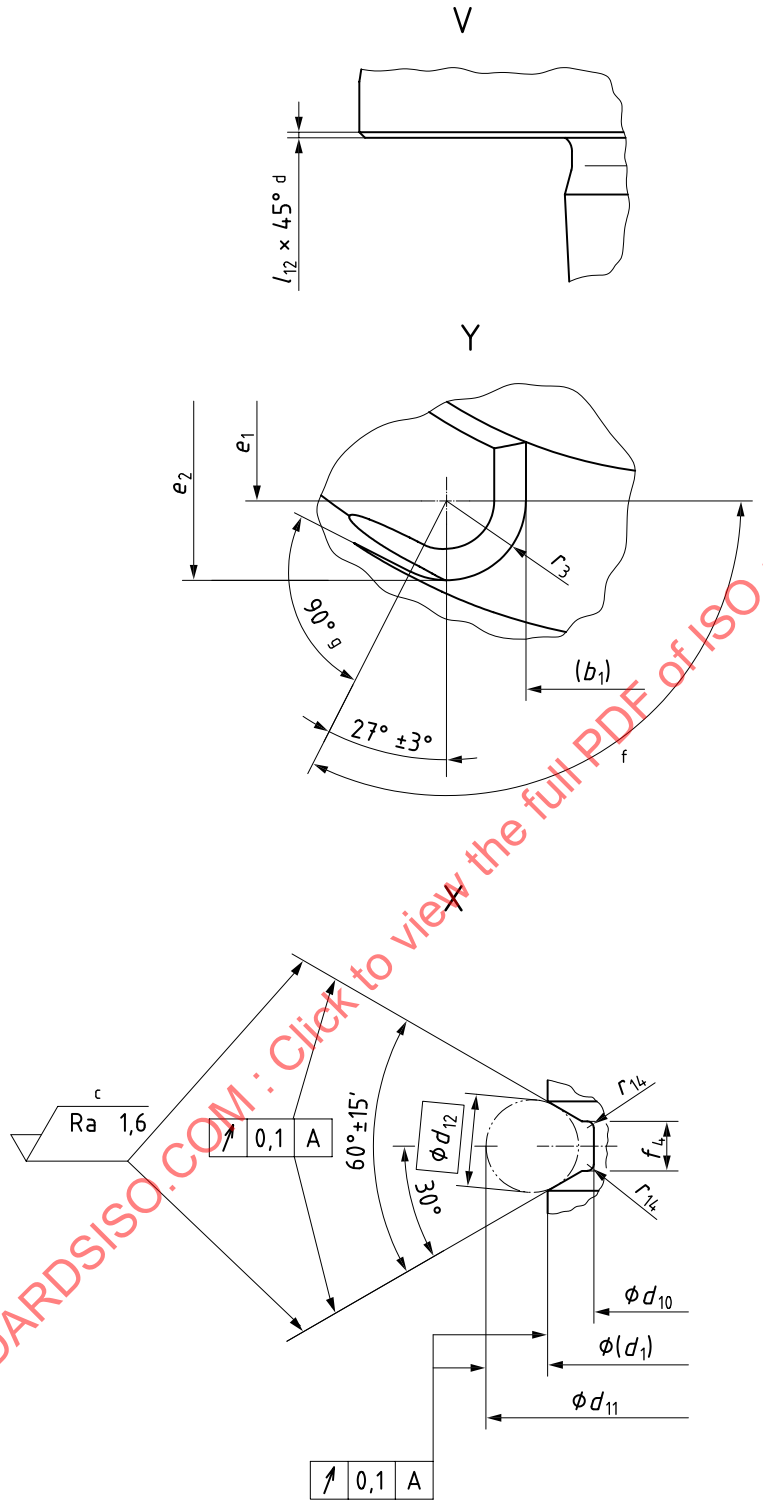
a) HSK-A and HSK-AB main and side view



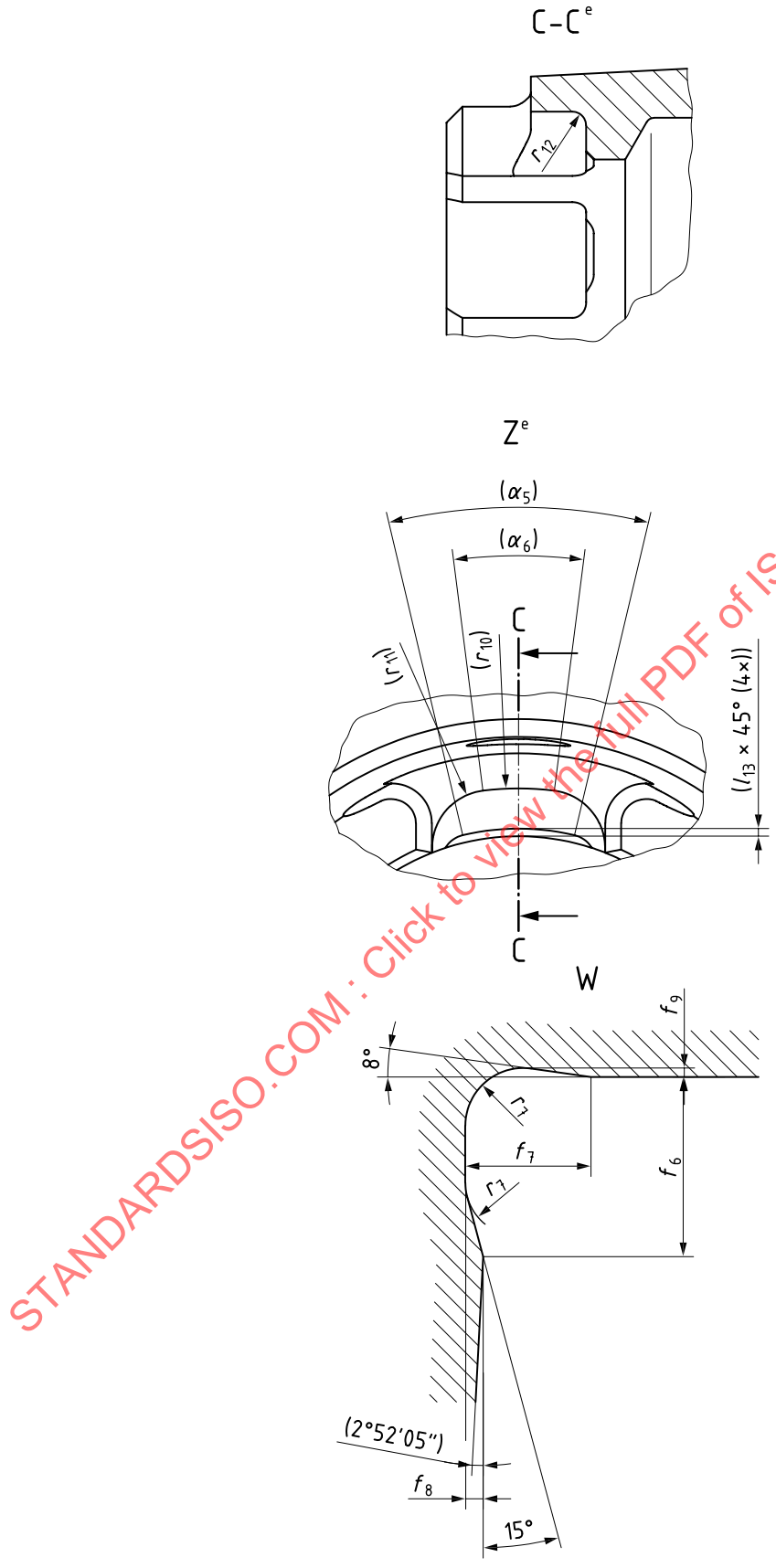
b) HSK-A and HSK-AB section A-A and section B-B



c) HSK-AB recesses



d) HSK-A and HSK-AB details



e) HSK-A and HSK-AB details

Key

1	position of the cutting edge for right hand tools with single cutting edge	c	Fine turning.
2	bore hole for data chip (also see 4.2.2 for data chip mass compensations) for type A optional	d	Or radius.
3	balancing recesses for type AB	e	Balancing recesses (#3) only apply to HSK-AB.
a	Or max. chamfer 0,3 × 45°.	f	Area of r_3.
b	Not convex.	g	Leadout of r_3.

All radial bore holes shall be deburred.

NOTE The HSK-AB taper shank flange has unbalances of different axial positions (axial OD grooves, "German notch" and data chip bore) which creates a certain dynamic unbalance. The balancing measures of 4.2.2 in combination with the (3) recesses of Figure 1 remove this dynamic unbalance.

Figure 1 — HSK-A and HSK-AB

4.2.2 Balancing measures and basic dimensions

4.2.2.1 General

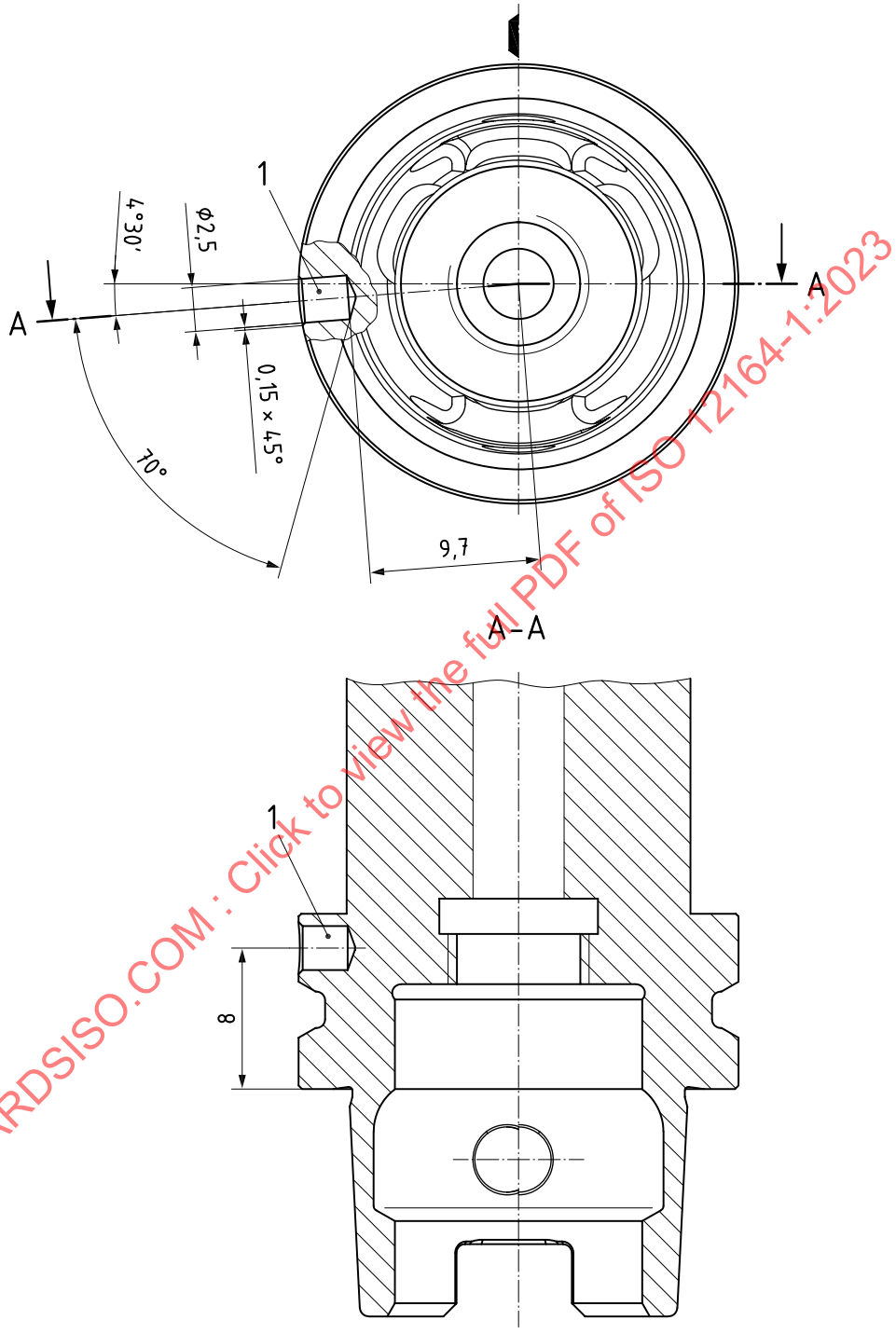
The balancing measures described in this subclause and Table 1 and the recesses included in 4.2.1 and 4.2.2 have been set up for HSK-AB taper shanks that are manufactured to the middle of their tolerance ranges. As the dimensions of these balancing measures depend on this condition, tolerances have not been defined. For example, the unbalance compensation of a mounted data chip (assumed data chip mass 700 mg) depends on diameter d_1 (tolerance h10) of the HSK taper shank flange.

The shape of the balancing measures can be chosen freely to the manufacturer's discretion, but within the proposed areas. If the theoretical dimensions in Table 1 are to be modified by the manufacturer's discretion, the stability as well as the functionality shall not be negatively affected.

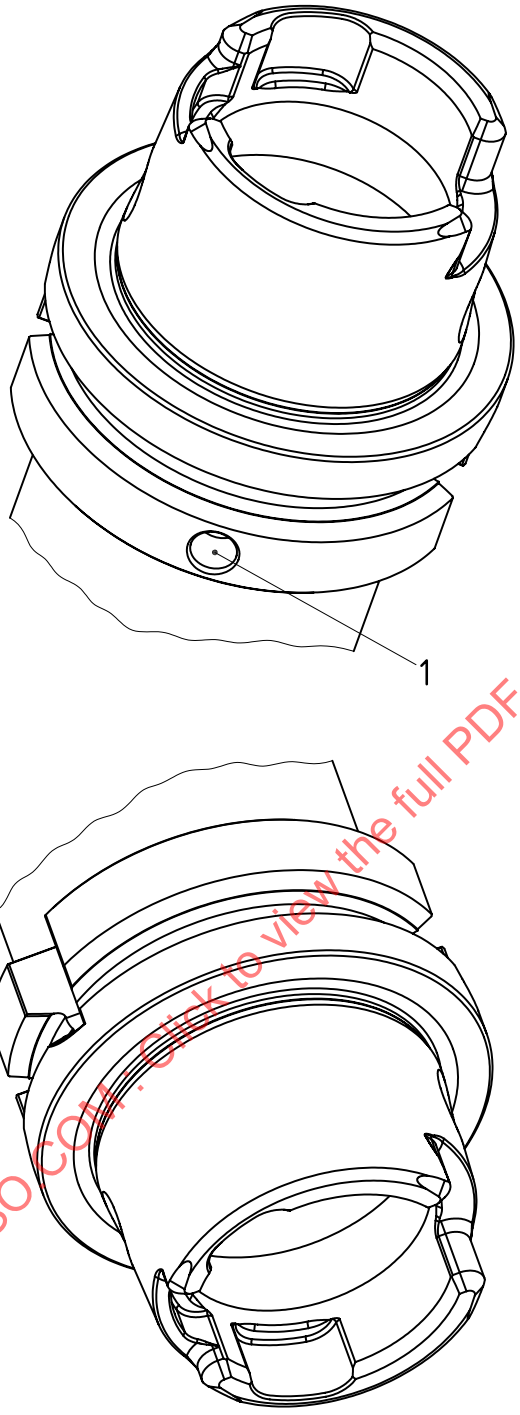
NOTE All balancing bore holes marked with the suffix superscript "a" are only required with a mounted data chip.

4.2.2.2 HSK-AB 25

Figure 2 is applied to HSK-AB 25 only.



a) HSK-AB 25 side view and section A-A



b) HSK-AB 25 position of balancing bore hole

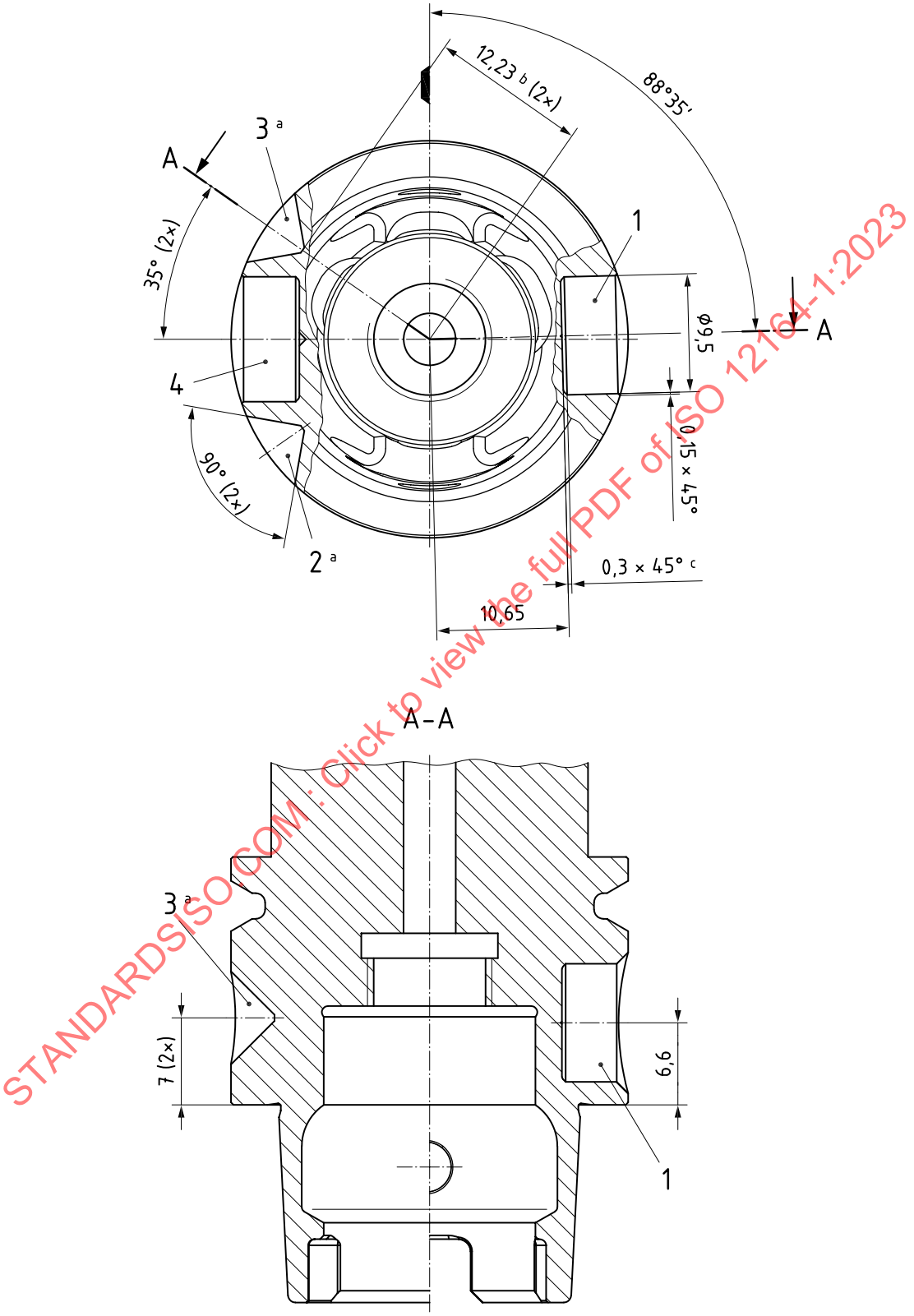
Key

1 balancing bore hole

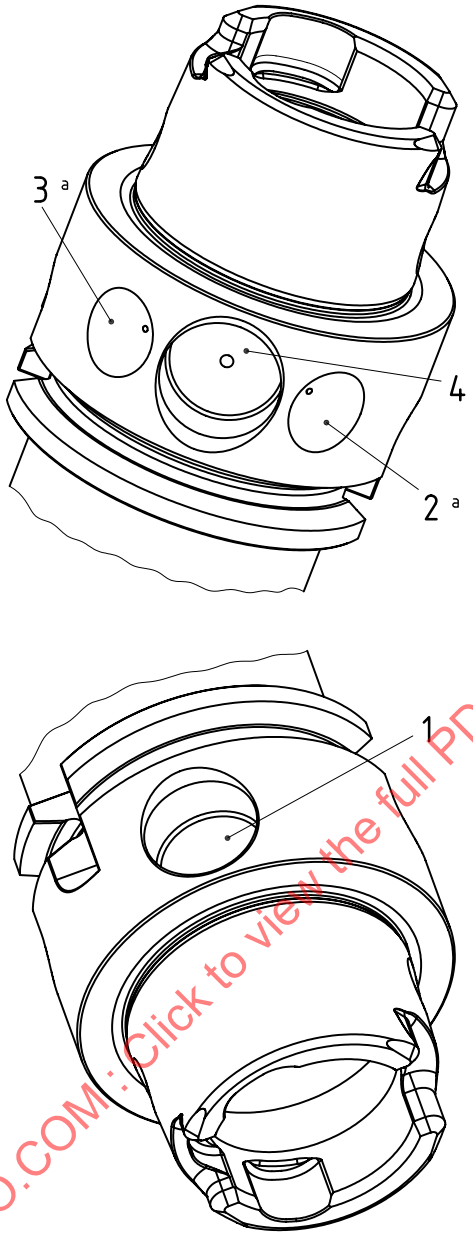
Figure 2 — HSK-AB 25

4.2.2.3 HSK-AB 32

Figure 3 is applied to HSK-AB 32 only.



a) HSK-AB 32 side view and section A-A



b) HSK-AB 32 position of balancing and data chip bore holes

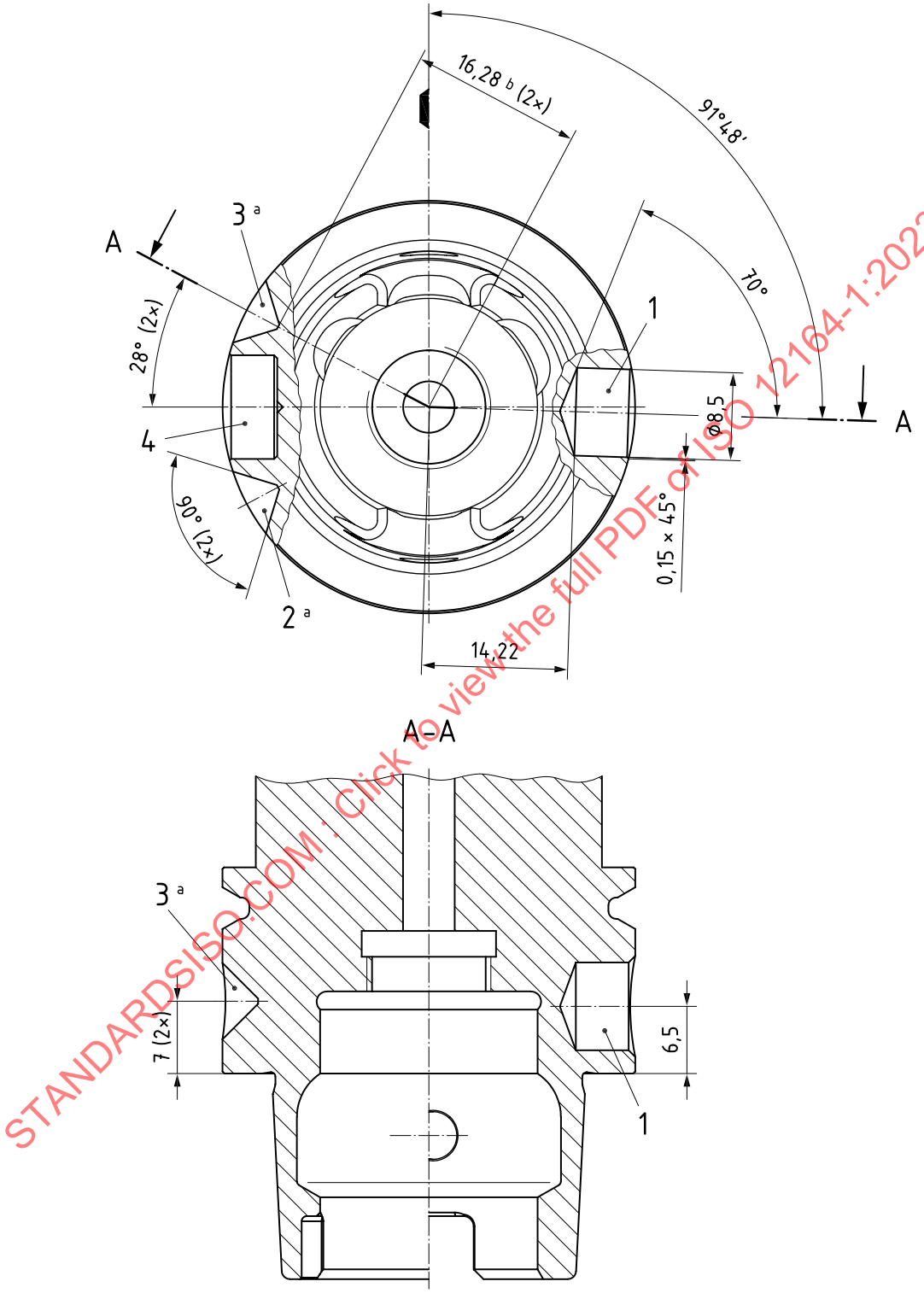
Key

1, 2, 3	balancing bore hole
4	bore hole for data chip
a	Bore hole only required if data chip mounted.
b	Dimension refers to the virtual point of the 90° balancing counter bore.
c	Or radius.

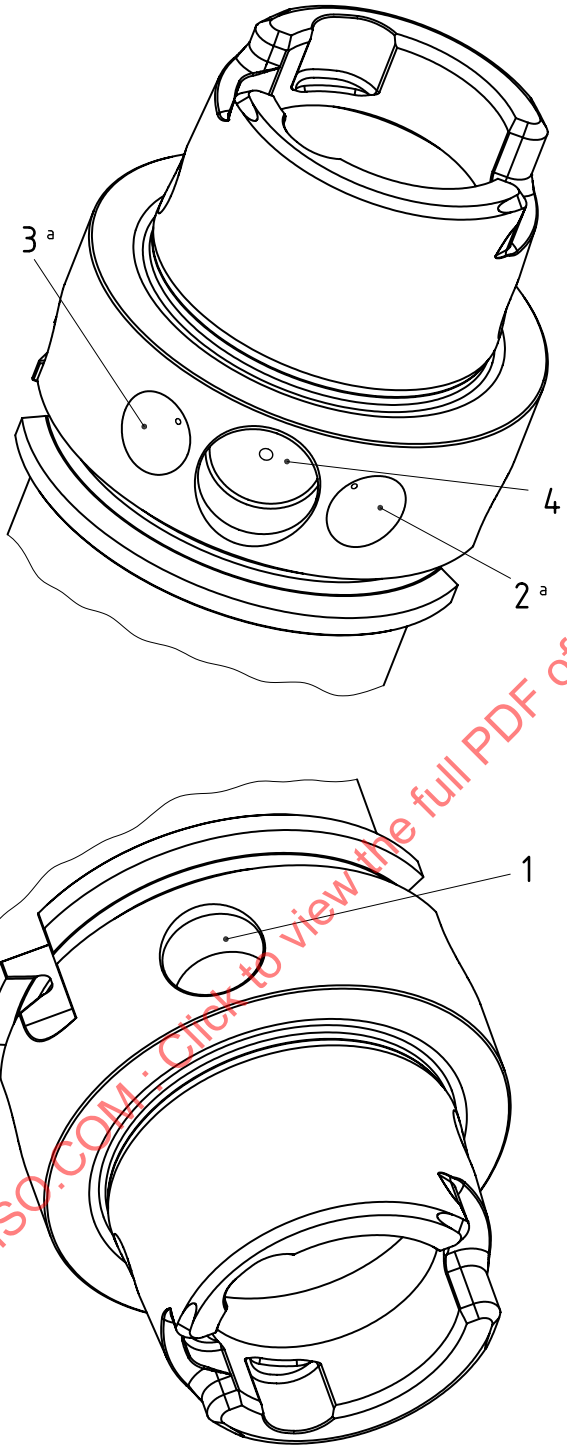
Figure 3 — HSK-AB 32

4.2.2.4 HSK-AB 40

Figure 4 is applied to HSK-AB 40 only.



a) HSK-AB 40 side view and section A-A



b) HSK-AB 40 position of balancing and data chip bore holes

Key

1, 2, 3 balancing bore hole

4 bore hole for data chip

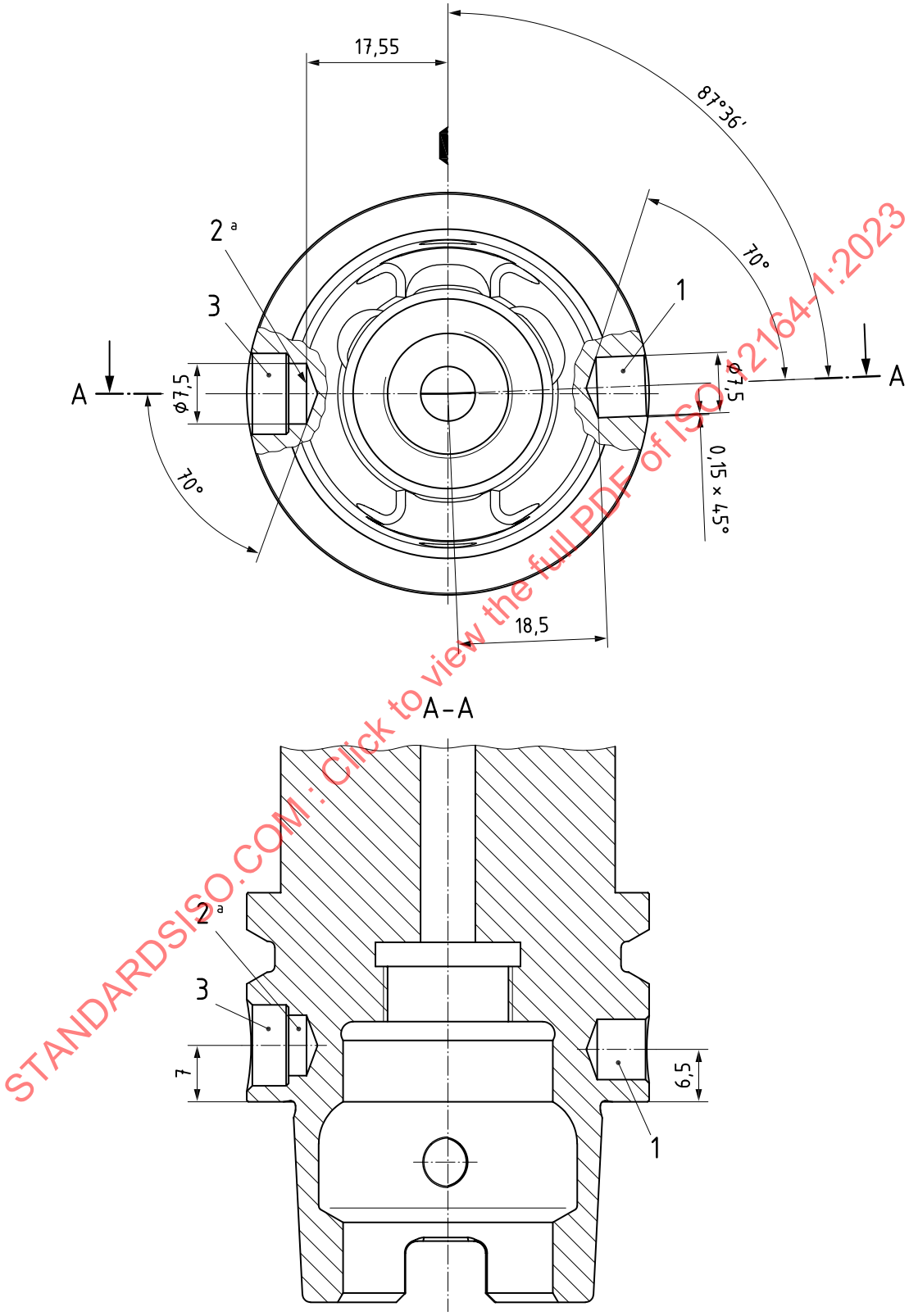
a Bore hole only required if data chip mounted.

b Dimension refers to the virtual point of the 90° balancing counter bore.

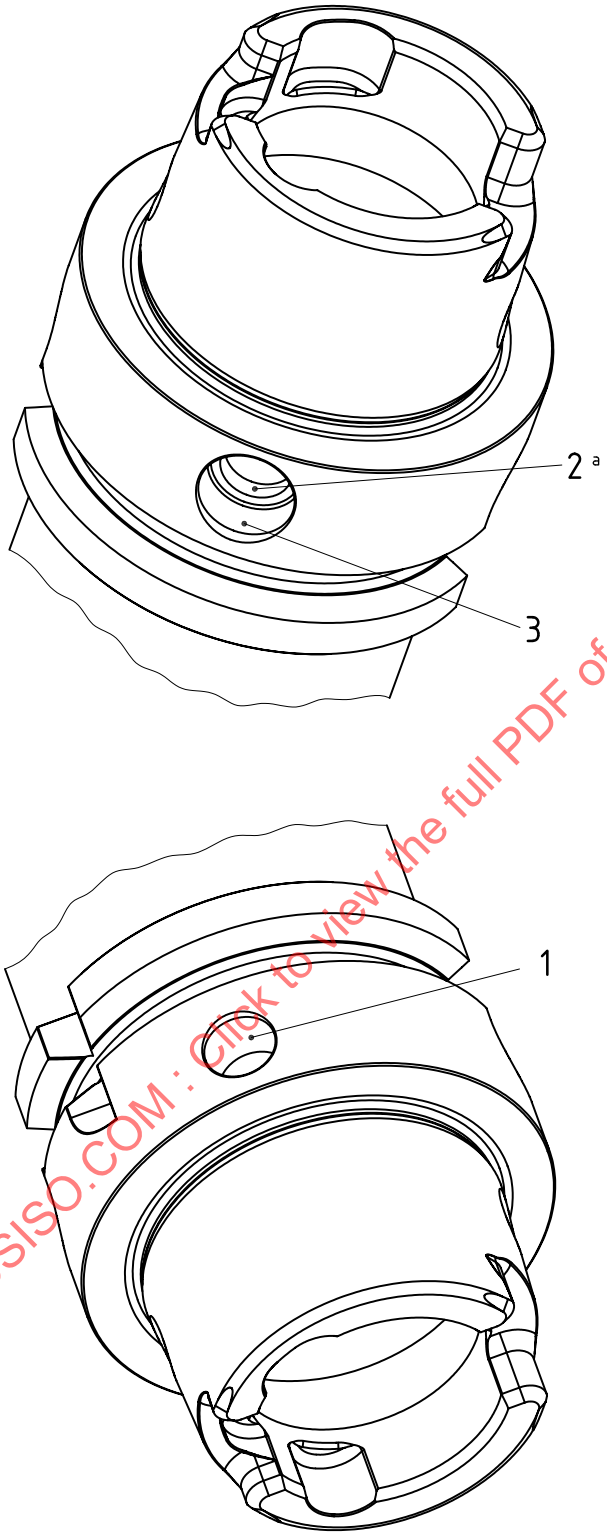
Figure 4 — HSK-AB 40

4.2.2.5 HSK-AB 50

Figure 5 is applied to HSK-AB 50 only.



a) HSK-AB 50 side view and section A-A



b) HSK-AB 50 position of balancing and data chip bore holes

Key

1, 2 balancing bore hole

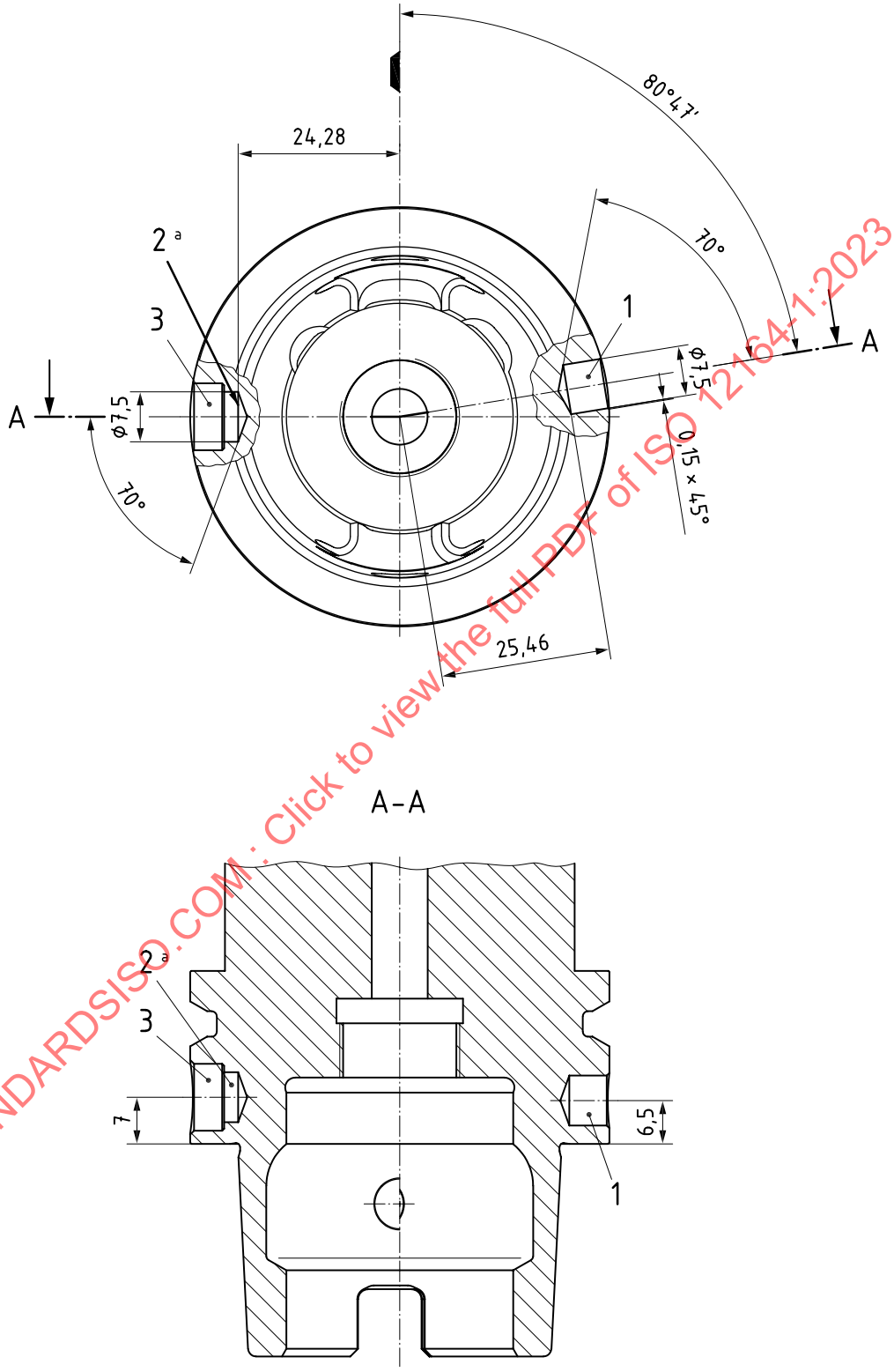
3 bore hole for data chip

[a] Bore hole only required if data chip mounted (bore holes sidewise of data chip bore also possible).

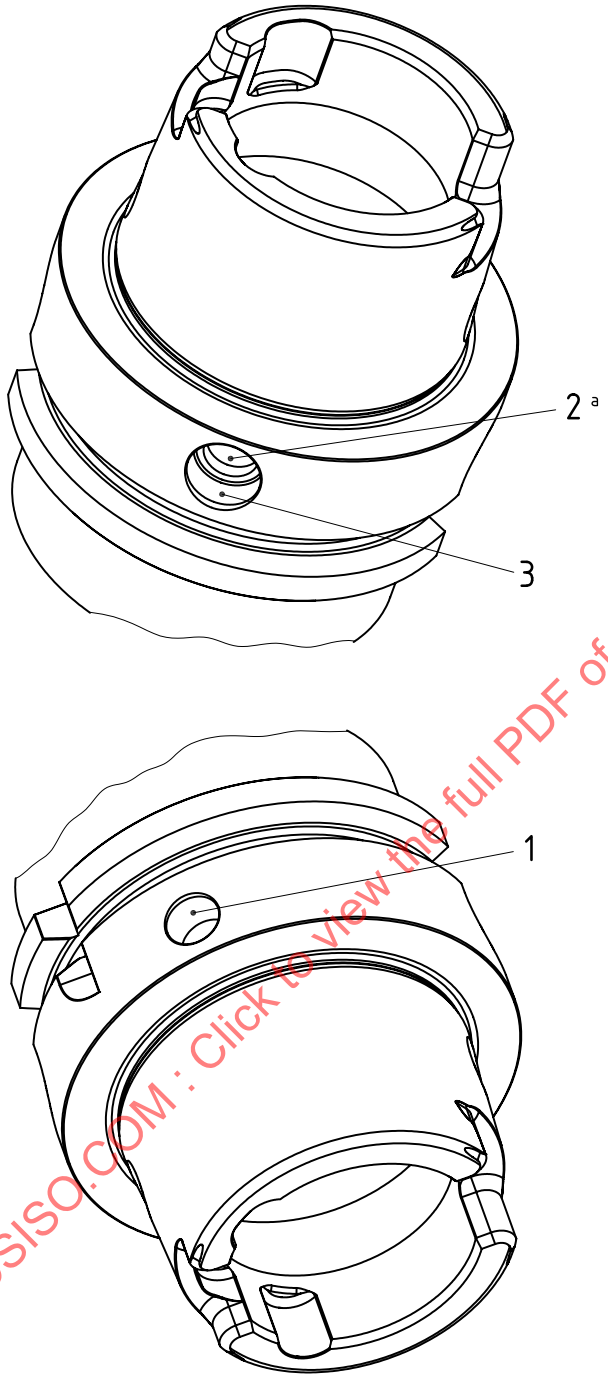
Figure 5 — HSK-AB 50

4.2.2.6 HSK-AB 63

Figure 6 is applied to HSK-AB 63 only.



a) HSK-AB 63 side view and section A-A



b) HSK-AB 63 position of balancing and data chip bore holes

Key

1, 2 balancing bore hole

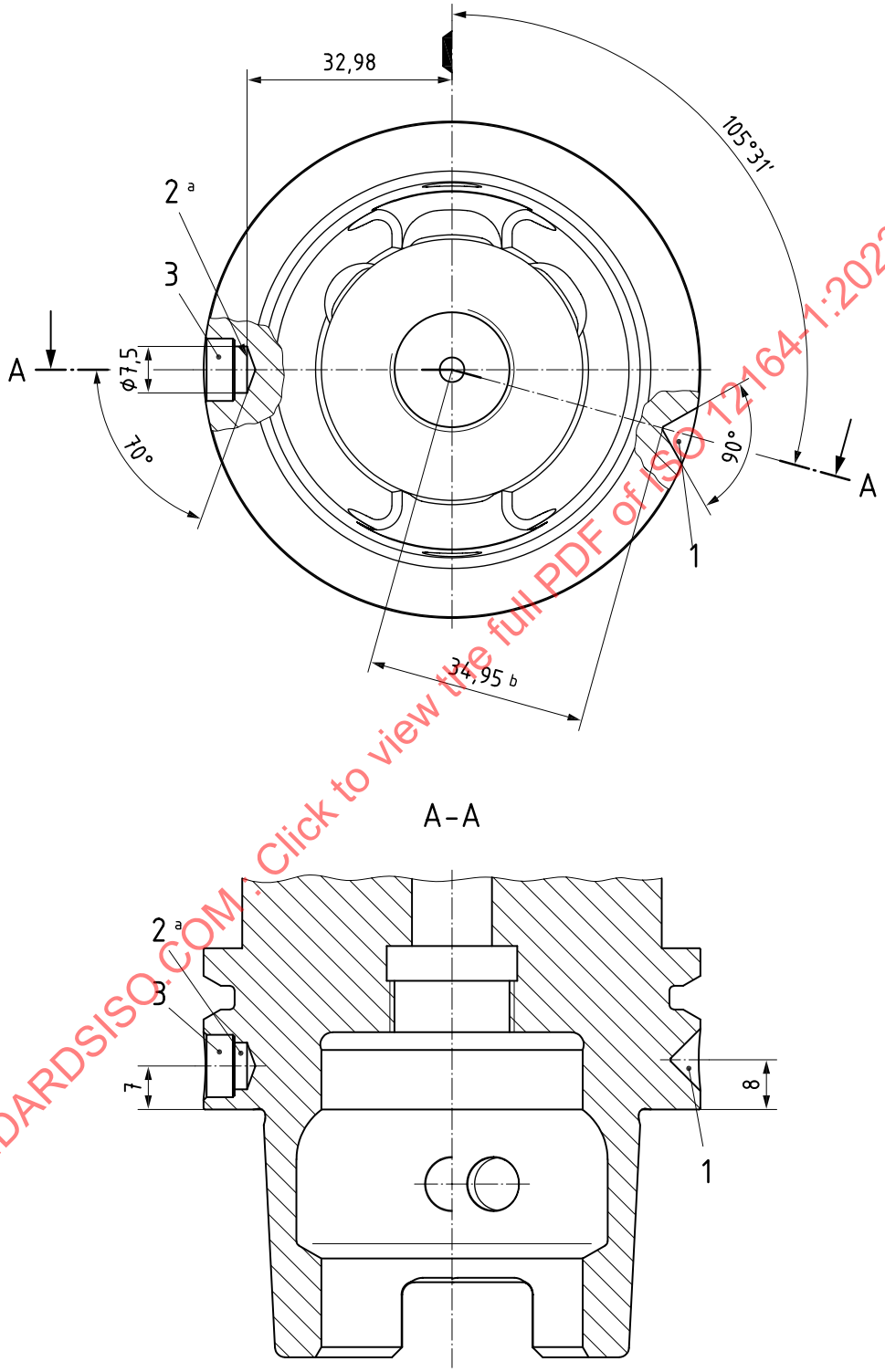
3 bore hole for data chip

[a] Bore hole only required if data chip mounted (bore holes sidewise of data chip bore also possible).

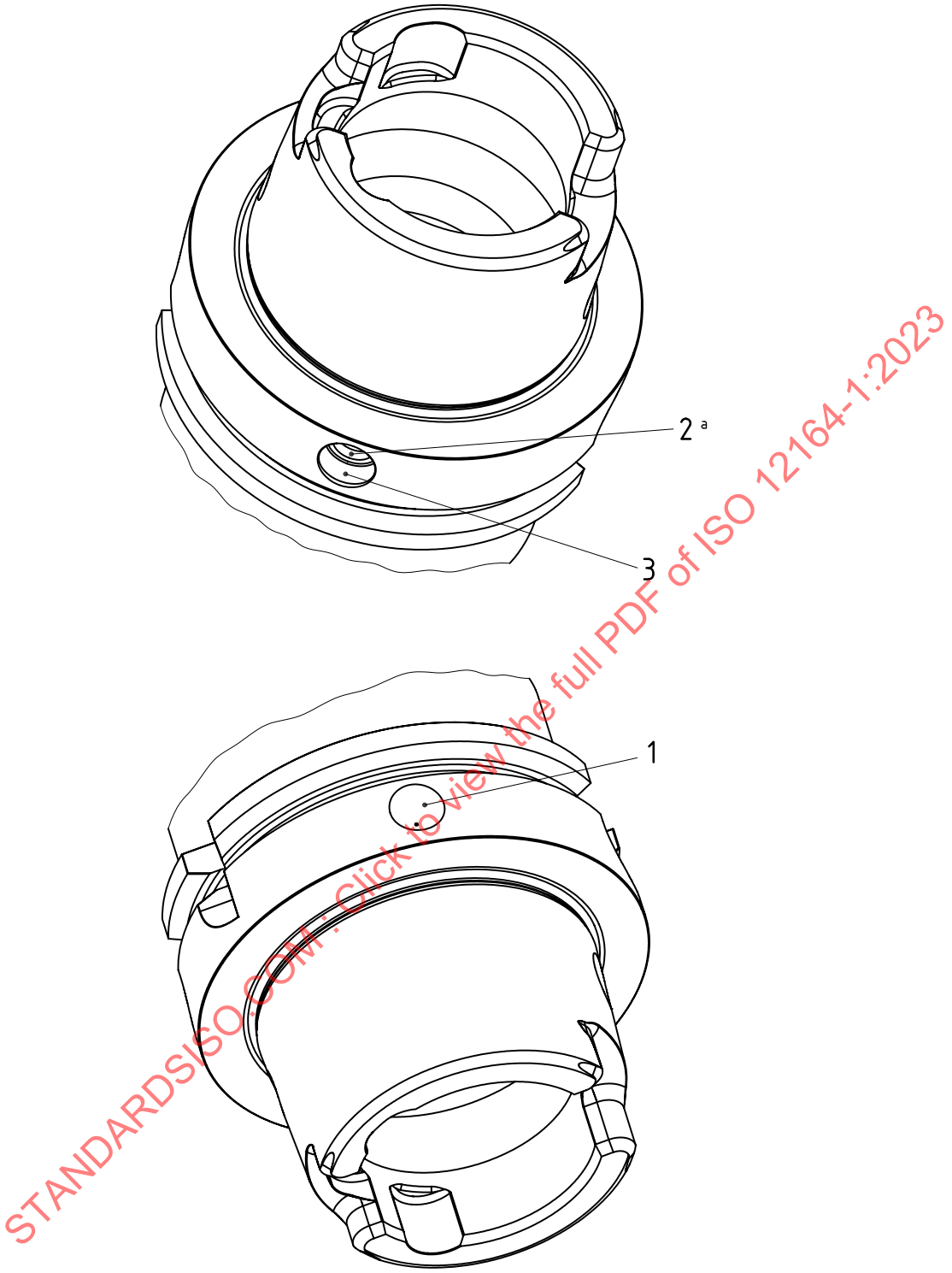
Figure 6 — HSK-AB 63

4.2.2.7 HSK-AB 80

Figure 7 is applied to HSK-AB 80 only.



a) HSK-AB 80 side view and section A-A



b) HSK-AB 80 position of balancing and data chip bore holes

Key

1, 2 balancing bore hole

3 bore hole for data chip

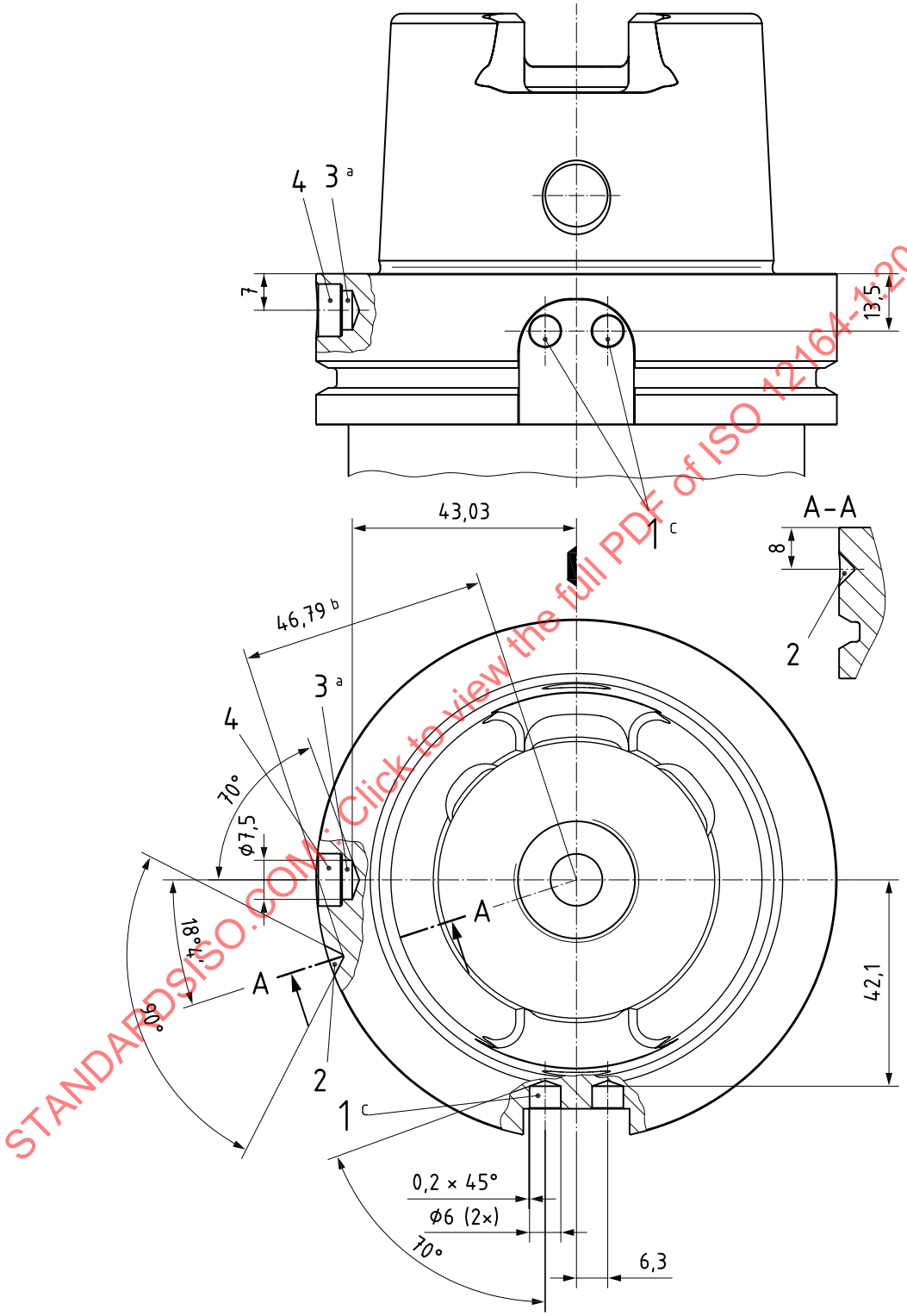
a Bore hole only required if data chip mounted (bore holes sidewise of data chip bore also possible).

b Dimensions refer to the virtual point of the 90° balancing counter bore.

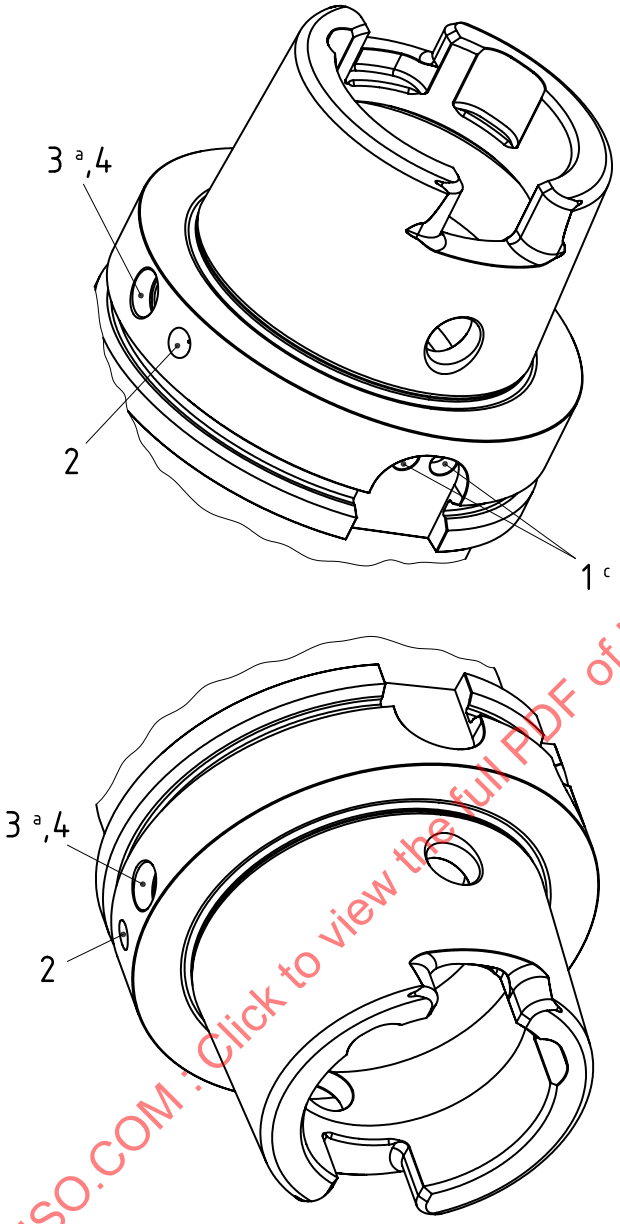
Figure 7 — HSK-AB 80

4.2.2.8 HSK-AB 100

Figure 8 is applied to HSK-AB 100 only.



a) HSK-AB 100 main and side view



b) HSK-AB 100 position of balancing and data chip bore holes

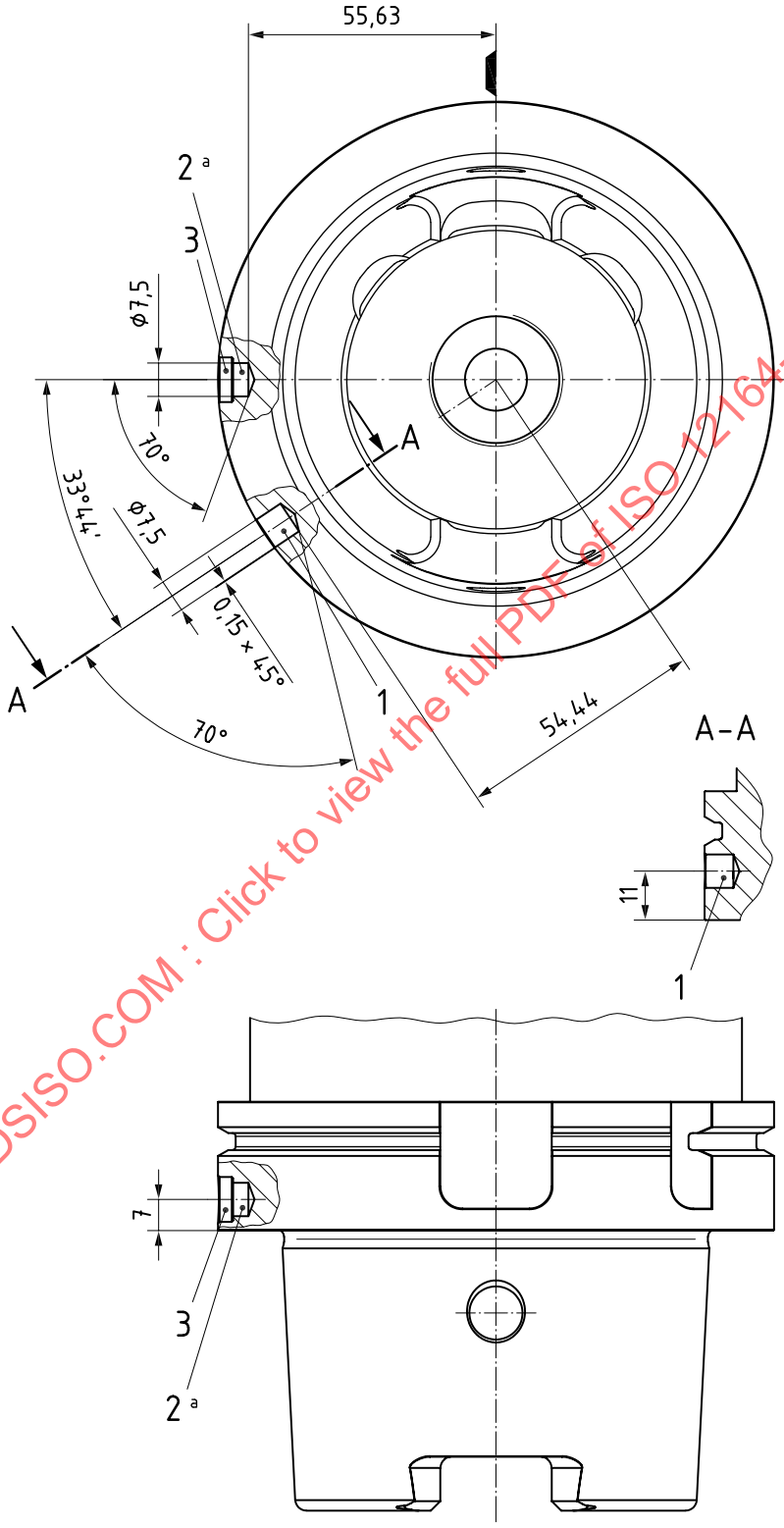
Key

1, 2, 3	balancing bore holes
4	bore hole for data chip
a	Bore hole only required if data chip mounted (bore holes sidewise of data chip bore also possible).
b	Dimension refers to the virtual point of the 90° balancing counter bore.
c	Bore holes sidewise of keyway also possible.

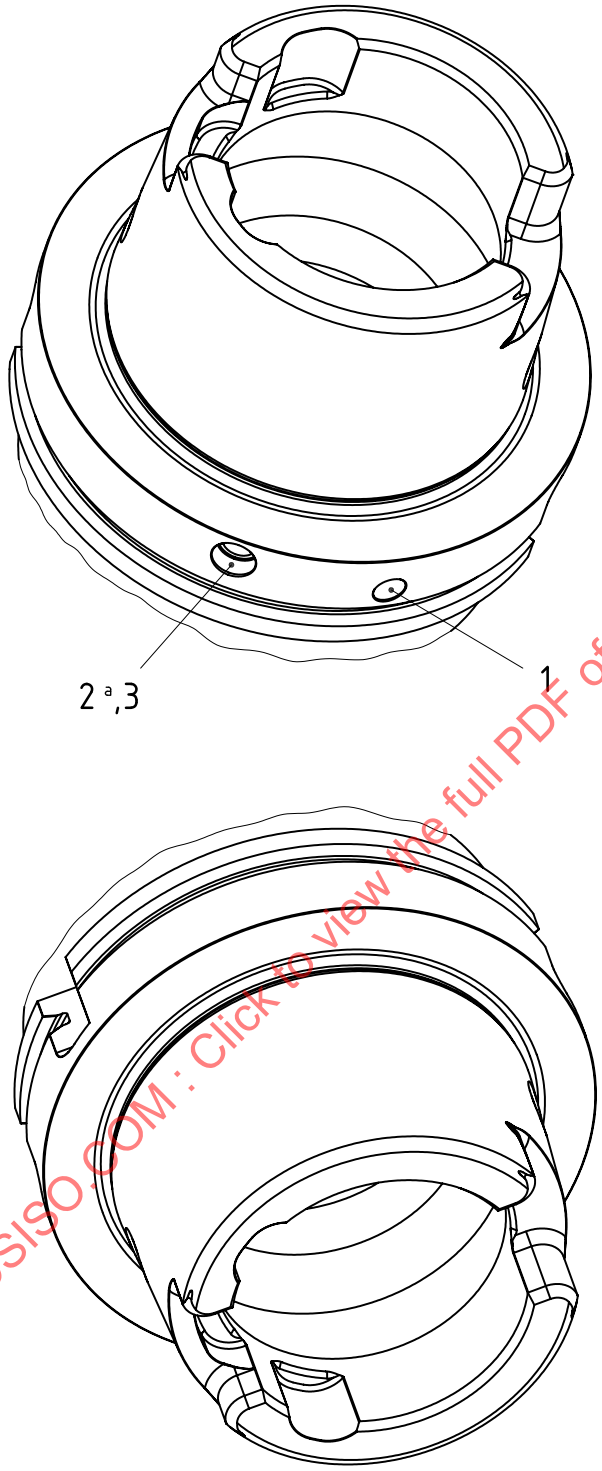
Figure 8 — HSK-AB 100

4.2.2.9 HSK-AB 125

Figure 9 is applied to HSK-AB 125 only.



a) HSK-AB 125 main and side view



b) HSK-AB 125 position of balancing and data chip bore holes

Key

1, 2 balancing bore hole

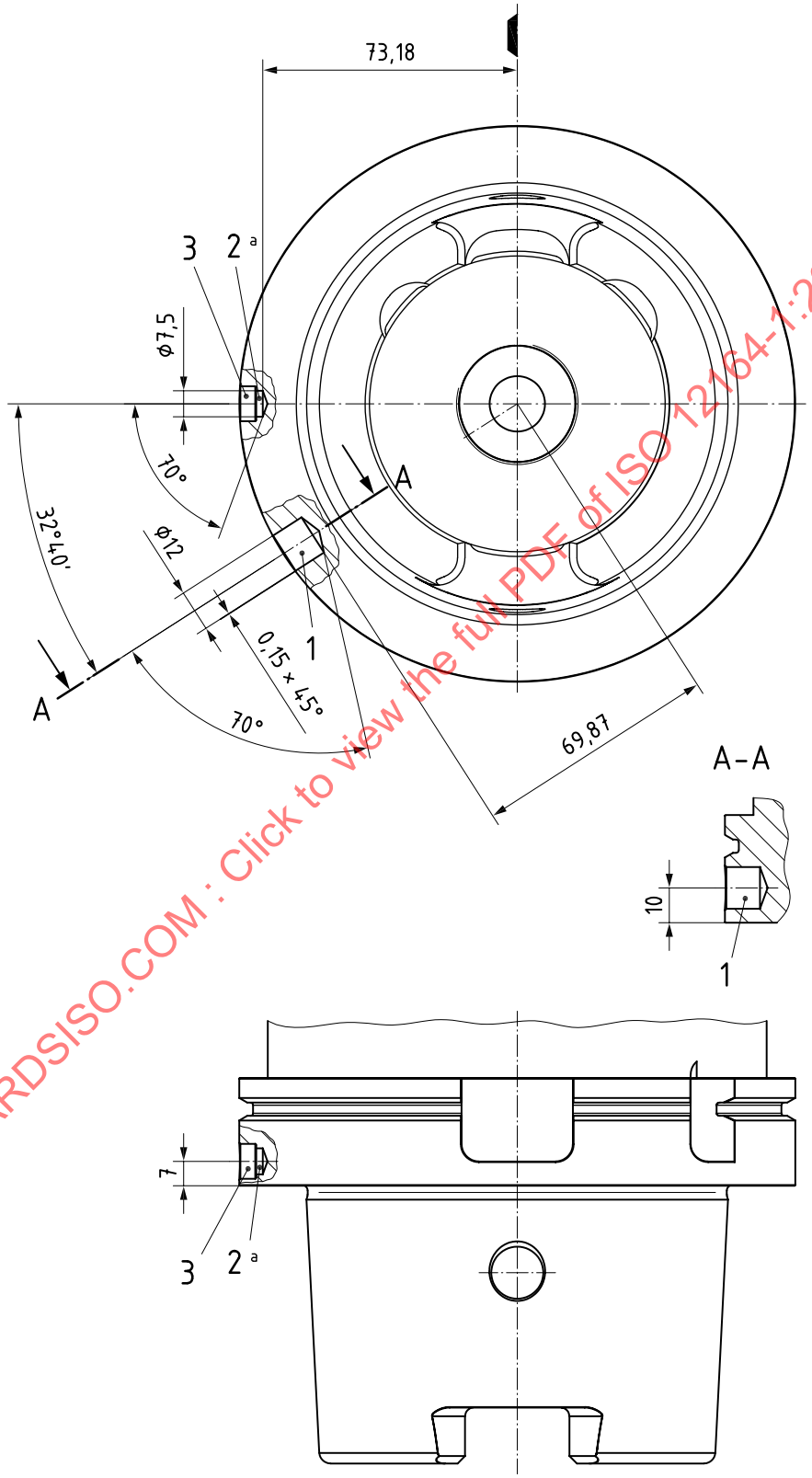
3 bore hole for data chip

[a] Bore hole only required if data chip mounted (bore holes sideways of data chip bore also possible).

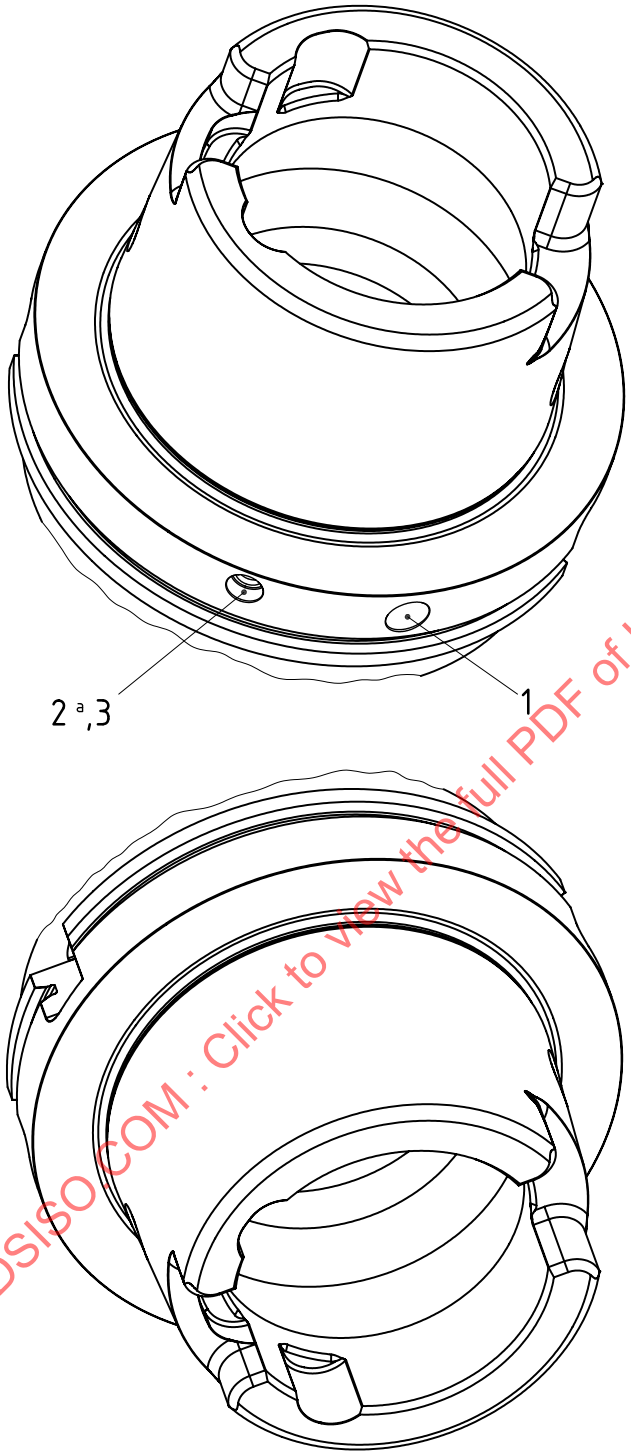
Figure 9 — HSK-AB 125

4.2.2.10 HSK-AB 160

Figure 10 is applied to HSK-AB 160 only.



a) HSK-AB 160 main and side view



b) HSK-AB 160 position of balancing and data chip bore holes

Key

1, 2 balancing bore hole

3 bore hole for data chip

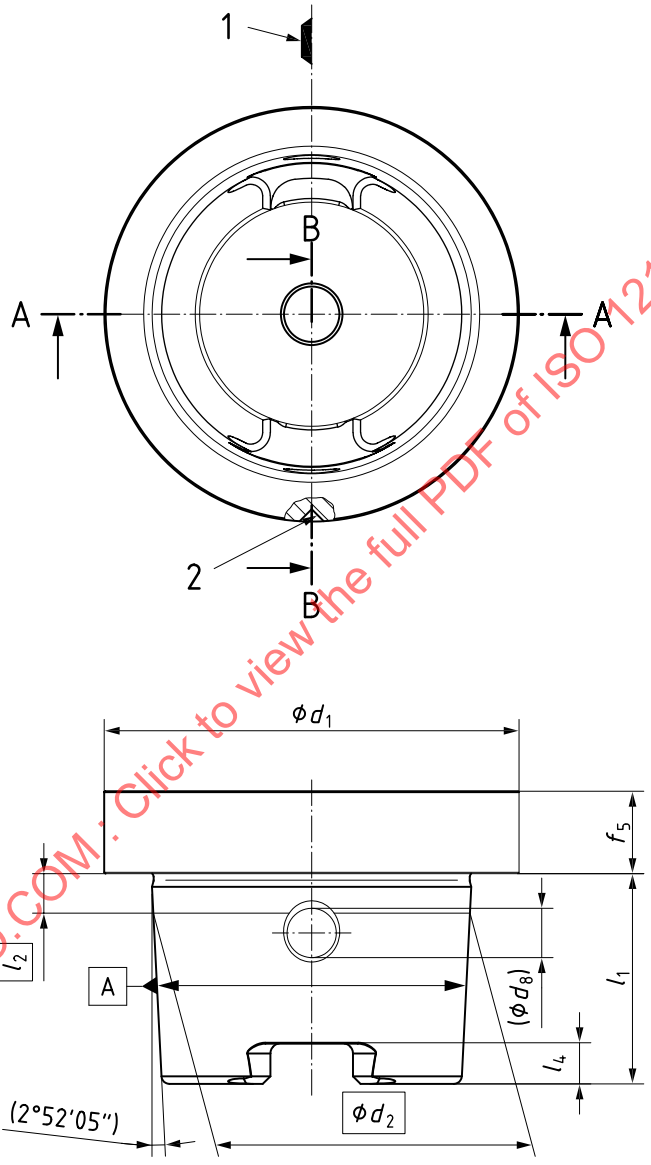
[a] Bore hole only required if data chip mounted (bore holes sideways of data chip bore also possible).

Figure 10 — HSK-AB 160

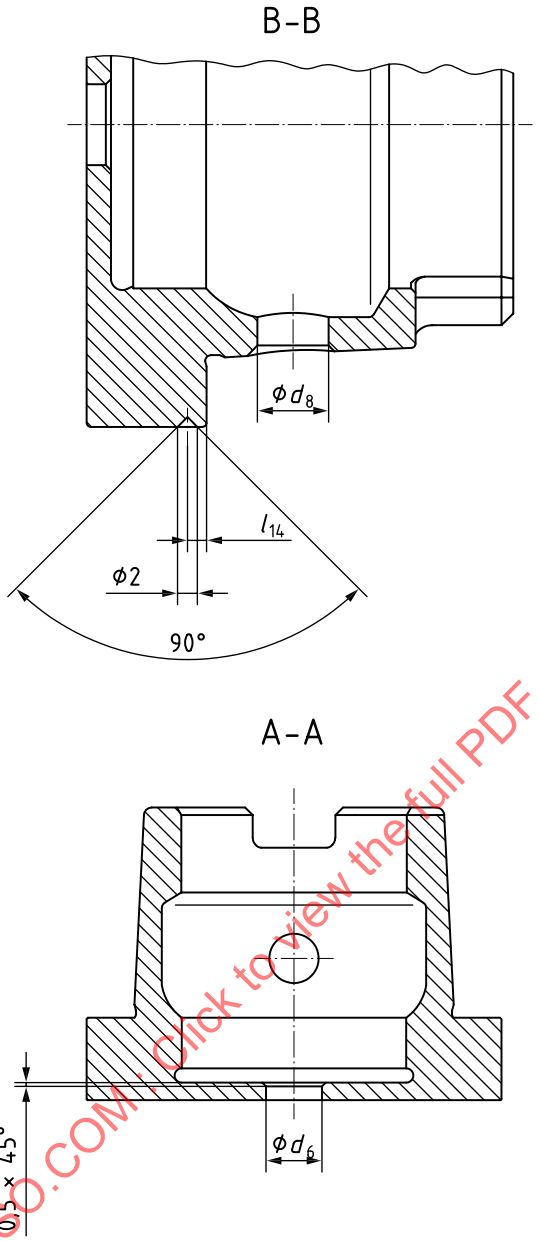
4.3 Hollow taper shank of types C and CB

4.3.1 Hollow taper shank of type C

Shanks of type C are not balanced. The widths f_5 and the other dimensions of HSK-C hollow taper shanks according to Figure 11 can be taken from Table 1. All unspecified dimensions shall be in accordance with Figure 1 and Table 1.



a) HSK-C main and side view



b) HSK-C section A-A and section B-B

Key

1 position of the cutting edge for right hand tools with single cutting edge

2 marking bore of the clamping hole position

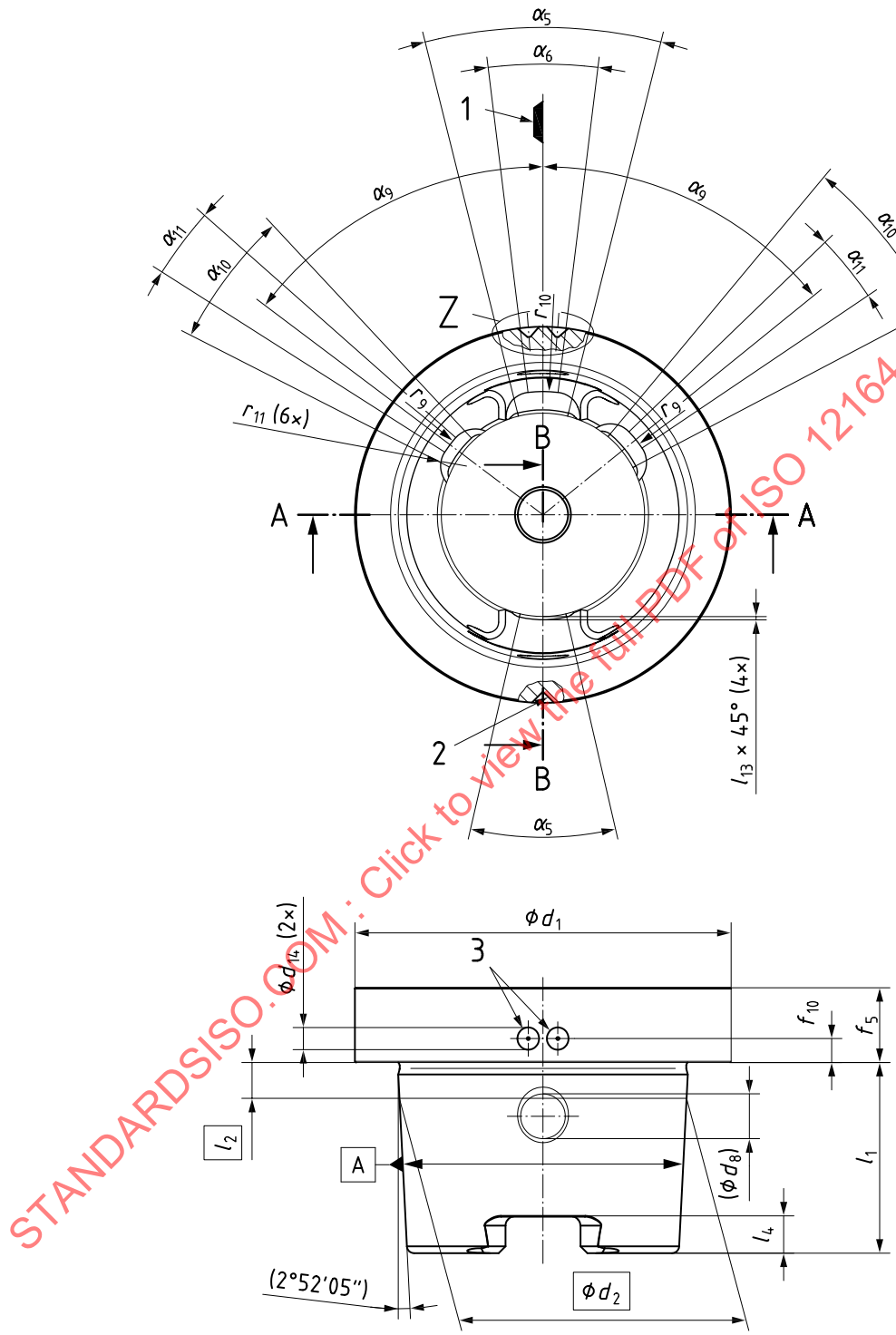
Figure 11 — Hollow taper shank of type C

4.3.2 Hollow taper shank of type CB and basic dimensions

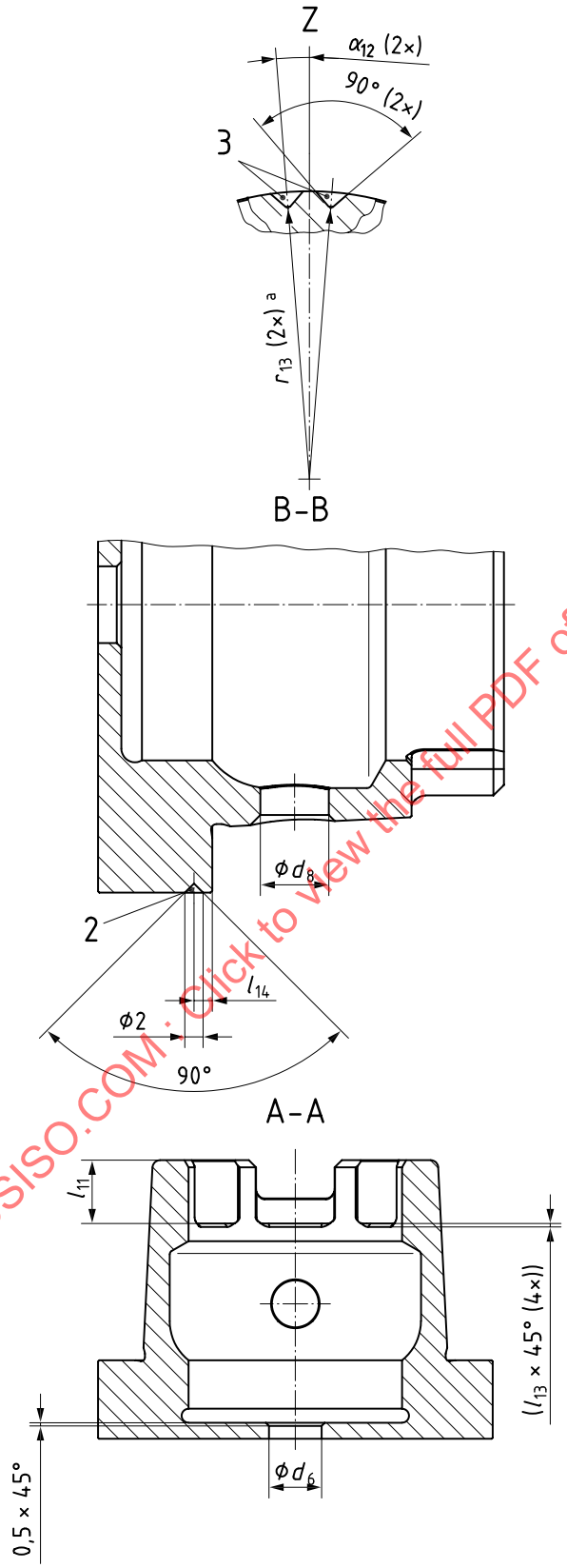
Shanks of type CB are dynamically balanced by design according to the same principle like shanks of type AB.

The three recesses inside the HSK-CB hollow taper shanks are symmetrical because HSK-CB shank flanges are symmetrical as well and do not cause unbalances (different to HSK-AB). The two small 90°-counterbores (#3) next to each other at the shank flange remove the small unbalance of the opposite marking bore as well as a minor dynamical unbalance caused by the little axial difference between the centres of gravity of the left respectively right recess and the removed mass at the low taper groove.

The dimensions of HSK-CB taper shanks of Figure 12 can be taken from Table 1. All unspecified dimensions shall be in accordance with Figure 1 and Table 1.



a) HSK-CB main and side view



b) HSK-CB section A-A and section B-B

Key

1 position of the cutting edge for right hand tools with single cutting edge

2 marking bore of the clamping hole position

3 90°-balancing counter bore holes

[a] Radius r_{13} refers to the virtual point of the two 90° balancing counter bores.

Figure 12 — Hollow taper shank of type CB

4.4 Hollow taper shank of type EB

The dimensions of hollow taper shanks of type EB are shown in Figure 13 and shall be in accordance with Figure 1 and Table 1 for unspecified dimensions.

The tolerance of reference diameter d_2 of the shanks of type EB has been standardized to the same value of the types AB and CB.

NOTE 1 The shank of type EB is completely symmetrical and thus dynamically balanced.

In case of the need for manual tool change of shanks of type EB, the radial access bore holes in the hollow taper may be manufactured according to Figure 1.

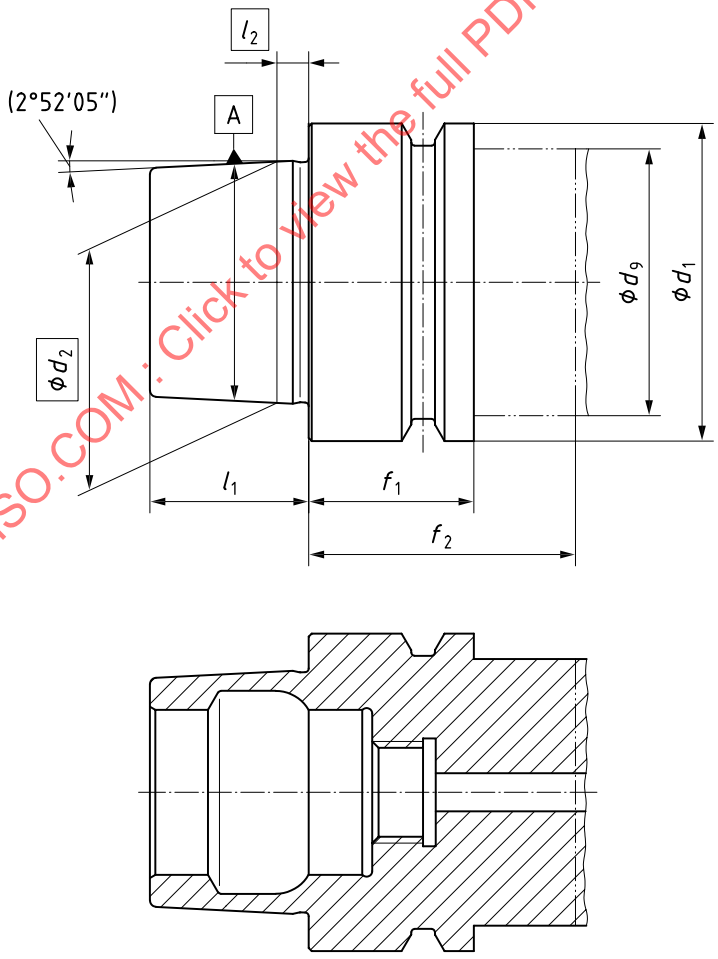


Figure 13 — Hollow taper shanks of type EB

4.5 Dimensions

The dimensions of hollow taper shanks defined in this document shall be in accordance with Table 1.

Table 1 — HSK hollow taper shanks, dimensions

Dimensions in millimetres

Nominal size		See Figure[c]	20	25	32	40	50	63	80	100	125	160	HSK-type
b_1	±0,04	1a, t	-	6,05	7,05	8,05	10,54	12,54	16,04	20,02	25,02	30,02	A, AB, C, CB
b_2	H10 Ⓔ	1b, B-B	-	6	7	9	12	16	18	20	25	32	A, AB
b_3	H10 Ⓔ	1b, B-B	-	7	9	11	14	18	20	22	28	36	A, AB
d_1	H10 Ⓔ	1a, b	20	25	32	40	50	63	80	100	125	160	A, AB, C, CB, EB
d_2		1a, b	15,203	19,006	24,007	30,007	38,009	48,01	60,012	75,013	95,016	120,016	A, AB, C, CB, EB
d_3	H10 Ⓔ	1b, A-A	11	14	17	21	26	34	42	53	67	85	A, AB, C, CB, EB
d_4	H11 Ⓔ	1b, A-A	13,1	16,4	20,5	25,5	32	40	50	63	80	100	A, AB, C, CB, EB
d_5		1b, A-A	12	15	19	23	29	37	46	58	73	92	A, AB, C, CB, EB
d_6	max.	1b, A-A	2,4	3	4,2	5	6,8	8,4	10,2	12	14	16	A, AB, C, CB, EB
d_6 [b]	max.	-	-	-	5,4	7	8	10	10,2	12	-	-	only for MQL
d_7	0 -0,1	1b, A-A	11,4	14,4	17,4	21,8	26,6	34,5	42,5	53,8	68,1	86,1	A, AB, C, CB, EB
d_8		1a, b	-	3,7	4	4,6	6	7,5	8,5	12	14,5	17	A, AB, C, CB, (EB)
d_9	max.	1a, b	16	20	26	34	42	53	68	88	111	144	A, AB, EB
d_{10}	0 -0,1	1d, X	17	22	26,5	34,8	43	55	70	92	117	152	A, AB, EB
d_{11}	0 -0,1	1d, X	23,9	28,5	37	45	59,3	72,3	88,8	109,75	134,75	169,75	A, AB, EB
d_{12}		1d, X	3	3	4	4	7	7	7	7	7	7	A, AB, EB
d_{13} [a]		1b, A-A	M6x0,75	M8x1	M10x1	M12x1	M16x1	M18x1	M20x1,5	M24x1,5	M30x1,5	M35x1,5	A, AB, C, CB, EB
d_{14}		12a, b	-	1,77	2,11	2,45	3,05	3,73	4,4	5,56	7,15	8,55	CB
e_1		1a, t	-	6,84	8,82	11	13,88	17,99	21,94	27,37	35,37	44,32	A, AB, C, CB

[a] Thread for mounting of a medium-transfer unit (see Annex B).

[b] Maximum diameter only applied in case of MQL (minimum quantity lubrication).

[c] Indicates the drawing of the first appearance of a parameter; e.g. '1a, b' → Figure 1 a), bottom drawing; '11b, Z', → Figure 11 b), view Z; '1b, B-B' → Figure 1 b), cross section B-B.

[d] The need of the O-ring depends on the used clamping system (is not part of the delivery).

Table 1 *(continued)*

Nominal size		See Figure[c]	20	25	32	40	50	63	80	100	125	160	HSK-type
e_2	0 -0,05	1a, t	-	7,97	10,2	12,88	16,26	20,87	25,82	32,25	41,25	52,2	A, AB, C, CB
f_1	0 -0,1	1a, b	8	10	20	20	26	26	26	29	29	31	A, AB, EB
f_2	min.	1a, b	16	20	35	35	42	42	42	45	45	47	A, AB, EB
f_3	±0,1	1a, b	3,5	4,5	16	16	18	18	18	20	20	22	A, AB, EB
f_4	+0,15 0	1d, X	2	2	2	2	3,75	3,75	3,75	3,75	3,75	3,75	A, AB, EB
f_5		12a, b	-	8	10	10	12,5	12,5	16	16	2	2	C, CB
f_6		1d, W	1	1	1	2	2	2	2,5	2,5	4	4	A, AB, C, CB, EB
f_7	≈	1d, W	0,9	0,9	0,9	1,1	1,4	1,4	1,8	1,8	3,1	3,1	A, AB, C, CB, EB
f_8	+0,1 0	1d, W	0,1	0,1	0,1	0,2	0,2	0,2	0,2	0,2	0,3	0,3	A, AB, C, CB, EB
f_9	+0,05 0	1d, W	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,2	0,2	A, AB, C, CB, EB
f_{10}	±0,1	12a, b	-	3	3	3	4	4	6	6	6	7	CB
h_1	0 -0,2	1b, B-B	-	10	13	17	21	26,5	34	44	55,5	72	A, AB
h_2	0 -0,3	1b, B-B	-	7,5	9,5	12	15,5	20	25	31,5	39,5	50	A, AB
h_3	+0,2 0	1a, t	-	-	5,4	5,2	5,1	5	4,9	4,9	4,8	4,8	A, AB
l_1	0 -0,2	1a, b	10	13	16	20	25	32	40	50	63	80	A, AB, C, CB, EB

[a] Thread for mounting of a medium-transfer unit (see Annex B).

[b] Maximum diameter only applied in case of MQL (minimum quantity lubrication).

[c] Indicates the drawing of the first appearance of a parameter; e.g. '1a, b' → Figure 1 a), bottom drawing; '11b, Z', → Figure 11 b), view Z; '1b, B-B' → Figure 1 b), cross section B-B.

[d] The need of the O-ring depends on the used clamping system (is not part of the delivery).

Table 1 *(continued)*

Nominal size		See Figure[c]	20	25	32	40	50	63	80	100	125	160	HSK-type
l_2		1a, b	2	2,5	3,2	4	5	6,3	8	10	12,5	16	A, AB, C, CB, EB
l_3	+0,2 0	1b, t	-	4	5	6	7,5	10	12	15	19	23	A, AB, C, CB
l_4	+0,2 0	1a, b	-	2	3	3,5	4,5	6	8	10	12	16	A, AB, C, CB
l_5	JS10 Ⓔ	1b, t	5,8	7,21	8,92	11,42	14,13	18,13	22,85	28,56	36,27	45,98	A, AB, C, CB, EB
l_6	0 -0,1	1b, t	5	6	8	8	10	10	12,5	12,5	16	16	A, AB, C, CB, EB
l_7	+0,3 0	1b, t	0,5	0,6	0,8	0,8	1	1	1,5	1,5	2	2	A, AB, C, CB, EB
l_8	±0,1	1a, b	-	4	5	6	7,5	9	12	15	18,5	25	A, AB, C, CB, (EB)
l_9	0 -0,3	1b, t	4	5	6	8	10	12	14	16	18	20	A, AB, C, CB, EB
l_{10}		1a, b	-	8	12	12	19	21	22	24	24	24	A, AB
l_{11}		1c, C	-	4,1	5,1	6,1	7,6	10,1	12,1	15,1	19,1	23,1	AB, CB
l_{12}		1d, V	0,3	0,3	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	A, AB, C, CB, EB
	tol.		±0,1	±0,1	±0,2	±0,2	±0,2	±0,2	±0,2	±0,2	±0,2	±0,2	
l_{13}		1c, C	-	0,25	0,3	0,35	0,45	0,55	0,7	0,85	1,1	1,35	AB, CB
l_{14}		12b, B-B	-	2	2	2	2	2	2	2	2	2	C, CB
O-ring [d]			-	-	16 × 1	18,77 × 1,78	21,89 × 2,62	29,82 × 2,62	36,09 × 3,53	47,6 × 3,53	61,91 × 3,53	80 × 3,5	A, AB, C, CB, EB
r_1		1a, b	0,4	0,5	0,6	0,8	1	1,2	1,6	2	2,5	3,2	A, AB, C, CB, EB
r_2	0 -0,2	1a, b	-	0,6	1	1	1,5	1,5	2	2	2,5	2,5	A, AB, C, CB

[a] Thread for mounting of a medium-transfer unit (see Annex B).

[b] Maximum diameter only applied in case of MQL (minimum quantity lubrication).

[c] Indicates the drawing of the first appearance of a parameter; e.g. '1a, b' → Figure 1 a), bottom drawing; '11b, Z', → Figure 11 b), view Z; '1b, B-B' → Figure 1 b), cross section B-B.

[d] The need of the O-ring depends on the used clamping system (is not part of the delivery).

Table 1 *(continued)*

Nominal size		See Figure[c]	20	25	32	40	50	63	80	100	125	160	HSK-type
r_3		1d, Y	-	1,13	1,38	1,88	2,38	2,88	3,88	4,88	5,88	7,88	A, AB, C, CB
	tol.		-	±0,03	±0,05	±0,05	±0,05	±0,05	±0,05	±0,05	±0,05	±0,05	
r_4		1b, t	2	3	4	5	6	8	10	12	16	20	A, AB, C, CB, EB
r_5		1b, t	0,3	0,3	0,4	0,4	0,5	0,6	0,8	1	1,2	1,6	A, AB, C, CB, EB
r_6		1b, t	0,5	0,5	0,5	1	1,5	1,5	2	2	2	2	A, AB, C, CB, EB
r_7		1d, W	0,2	0,2	0,2	0,4	0,6	0,6	1	1	1,6	1,6	A, AB, C, CB, EB
r_8		1a, b	-	3	3,5	4,5	6	8	9	10	5	5	A, AB
r_9	max. r_{10}	1c, b	-	8,08	9,9	12,4	15,3	19,35	23,9	29,8	38	48	AB, CB
r_{10}	max.	1c, b	-	8,1	10,1	12,6	15,9	20,49	25,6	31,65	40	50	AB, CB
r_{11}		1c, b	-	1,7	3,2	3,2	4,2	4,2	6,2	6,2	8.2	10,2	AB, CB
r_{12}		1d, C-C	-	0,6	1	1	1,5	1,5	2	2	2,5	2,5	AB, CB
r_{13}		12b, Z		11,59	14,92	18,75	23,45	29,61	37,77	47,19	58,89	75,69	CB
r_{14}		1d, X	0,5	0,5	0,5	0,5	1	1	1	1	1	1	A, AB, EB
	tol.		0 - 0,2	0 - 0,2	0 - 0,2	0 - 0,2	0 - 0,5	0 - 0,5	0 - 0,5	0 - 0,5	0 - 0,5	0 - 0,5	
t		1a, b	0,001 5	0,002	0,002	0,002	0,002 5	0,003	0,004	0,004	0,005	0,005	A, AB, C, CB, EB
w		1a, b	0,002	0,002	0,002	0,002	0,002	0,002	0,003	0,003	0,004	0,004	A, AB, C, CB, EB
α_1		1c, b	-	63°29’	67°46’	61°00’	60°21’	51°00’	55°55’	51°20’	51°24’	50°04’	AB
α_2		1c, b	-	64°20’	64°00’	56°30’	57°00’	53°00’	52°45’	50°00’	51°00’	50°00’	AB
α_3		1c, b	-	22°36’	32°48’	25°12’	28°18’	20°06’	22°38’	20°30’	22°42’	21°02’	AB
α_4		1c, b	-	20°24’	16°12’	10°00’	12°06’	8°36’	7°34’	8°00’	7°12’	4°26’	AB
α_5		1c, b	-	24°36’	23°12’	23°48’	26°24’	26°36’	26°00’	28°48’	29°24’	29°30’	AB, CB
α_6		1c, b	-	24°06’	8°00’	10°30’	10°36’	14°30’	10°48’	17°12’	15°30’	13°48’	AB, CB
α_7		1c, b	-	24°12’	21°36’	18°12’	17°12’	12°30’	15°40’	17°30’	19°30’	17°36’	AB

[a] Thread for mounting of a medium-transfer unit (see Annex B).

[b] Maximum diameter only applied in case of MQL (minimum quantity lubrication).

[c] Indicates the drawing of the first appearance of a parameter; e.g. ‘1a, b’ → Figure 1 a), bottom drawing; ‘11b, Z’, → Figure 11 b), view Z; ‘1b, B-B’ → Figure 1 b), cross section B-B.

[d] The need of the O-ring depends on the used clamping system (is not part of the delivery).