STANDARD 500 KW CONNECTOR FOR OFFSHORE CHARGING OF ELECTRIC CREW TRANSFER VESSELS
GENERAL ARRANGEMENT FOR CONNECTOR INTERFACING

PURPOSE OF GA

This general arrangement drawing is intended to provide a common basis of design for developers of CTV offshore charging infrastructure, including:

- Connector developers
- Vessel designers
- Offshore charging system developers

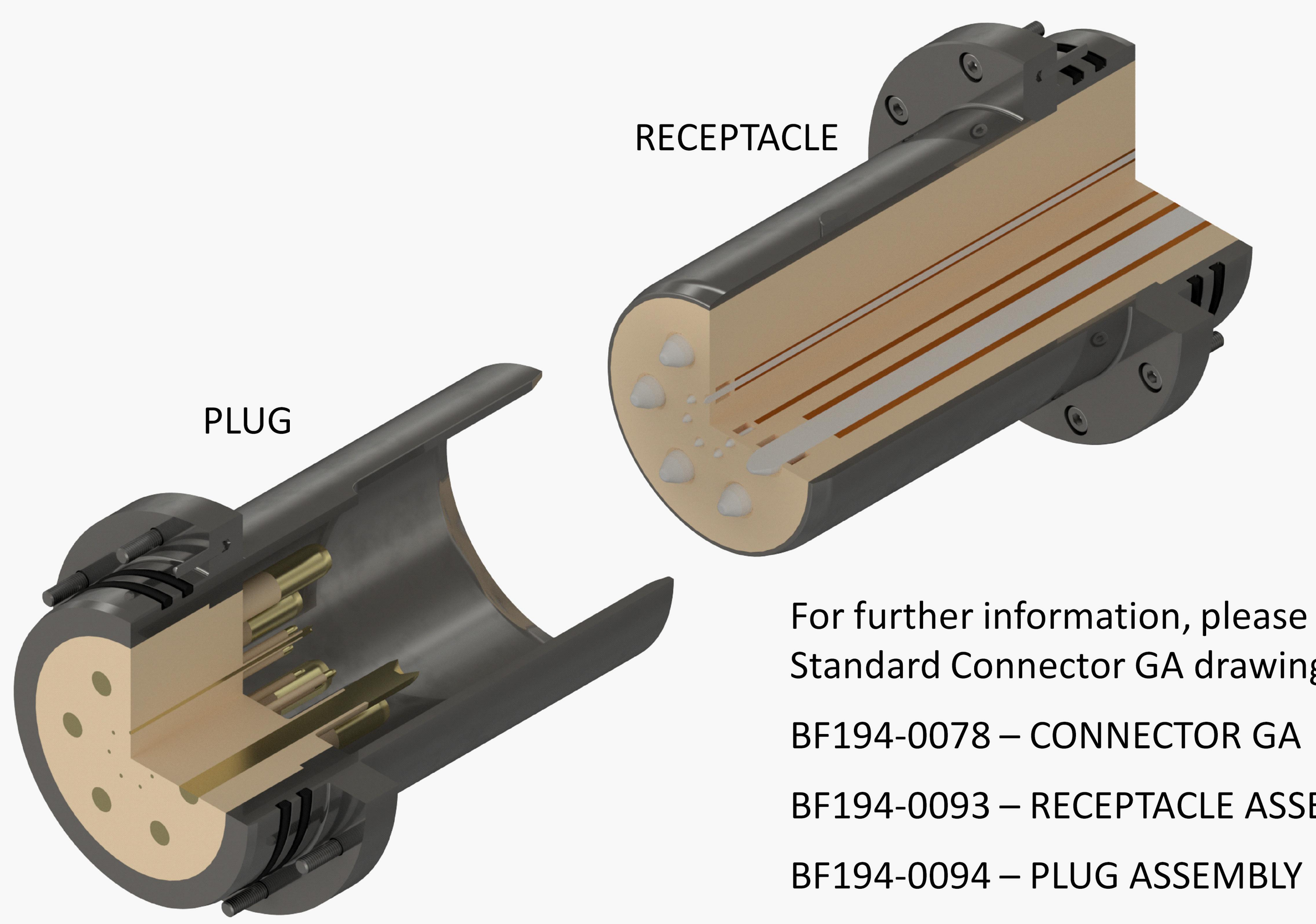
The standard connector consists of a plug and receptacle.

- The plug is to be installed on the offshore charging system cable, fixed to the offshore asset (wind turbine platform, charging buoy, offshore sub-station etc).
- The receptacle is to be installed on the vessel.

The GA defines all interfaces that are required to ensure compatibility between different connector manufacturers' designs, allowing any standard plug to be used with any standard receptacle. Additionally, vessels and charging systems that utilise connector interfaces that adhere to the standard connector GA will be able to accept any manufacturer's connector.

The GA presented does not represent a complete connector design, but instead provides defined space envelopes sufficient to allow connector developers to incorporate their own solutions for achieving sufficient pin contact pressure, ensuring sealing, terminating cables creating connector housings.

Wider offshore charging system features, such as automation, latching and emergency release are not prescribed in this standard connector GA, since solutions for these functions are numerous and as yet, largely unproven.



For further information, please refer to the Standard Connector GA drawings:

BF194-0078 – CONNECTOR GA

BF194-0093 – RECEPTACLE ASSEMBLY

BF194-0094 – PLUG ASSEMBLY

KEY CONNECTOR ATTRIBUTES

Power Connections	
Maximum voltage	1000 V DC
Maximum power	500 kW (subject to detailed design and qualification testing)
Number of pins	6 (3 +ve , 3 –ve)

Auxiliary Connections	
Number of pins	7
Communication	4 pins (Modbus TCP/IP)
Spare (Safety Pilot)	2 pins
Earth Ground Conductor	1 pin

Materials

Materials are specified on the GA, but developers are free to utilise alternatives that do are not detrimental to performance, availability or reliability.

Sealing

Provision has been made within the standard connector design for the implementation of various sealing solutions.

Static Seals	Static seal locations are provided at the connector housing interface. The seals are to ISO standard, but other standards can be used if compatible with the housing.
Pin sealing	Dummy male pins are shown within the receptacle to keep moisture and dirt out of the female pins. Connector developers must provide their own dummy pin actuation solution, such as spring-loading. Space has been allocated within the receptacle to include dynamic or wiper seals to run on the dummy pin and clean the male pin as it is mated.
Open face sealing of plug	GA provides recommendations for sealing between the insulator, plug housing and pins. Sealing of the exposed pins and connector open face are not defined as solutions may be specific to charge systems or connector developers.

Interfaces

All necessary interfaces have been defined within the standard connector design to ensure compatibility and interchangeability between different connector designs, vessels and charge systems.

Defined Plug Interfaces	Male pin interface dimensions Engagement length Connector housing interface with receptacle Coarse alignment slot Mounting flange Rear housing seal interface Cable termination space envelope
Defined Receptacle Interfaces	Female pin space envelope and interfacing dimensions of male pin Engagement lengths Connector housing interface with plug Coarse alignment pin Dummy pin space envelope and tip interface detail Mounting flange Rear housing seal interface Cable termination space envelope

REV	DATE	DESCRIPTION	BY	APP'D
2	01/10/2024	UPDATED ACCORDING TO C.T. COMMENTS. LARGER CONNECTOR BODY AND SPACINGS, PCD AND POSITIONING	ISM	ISM
1	30/11/2022	INITIAL ISSUE	ISM	TWA

MATERIAL: SEE BOM

GENERAL NOTES:

1. ALL DIMENSIONS IN MM UNLESS OTHERWISE STATED.
2. DEBURR AND BREAK SHARP EDGES.
3. DO NOT SCALE FROM DRAWING.
4. ALL TOLERANCES TO ISO-2768-mK UNLESS OTHERWISE SPECIFIED.
5. IF IN DOUBT, ASK.

BLACKFISH ENGINEERING LTD
4 UNITY STREET, BRISTOL, BS1 5HH
ENGLAND +44 1173 138123

MASS : 28.3 kg

DRAWING NO. : BF194-0078

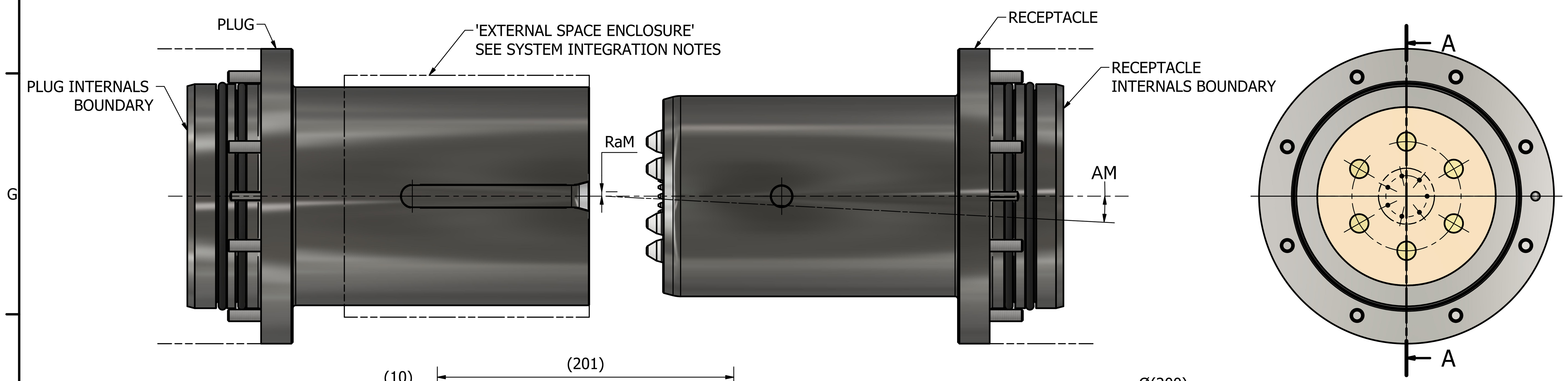
TITLE : CONNECTOR GA

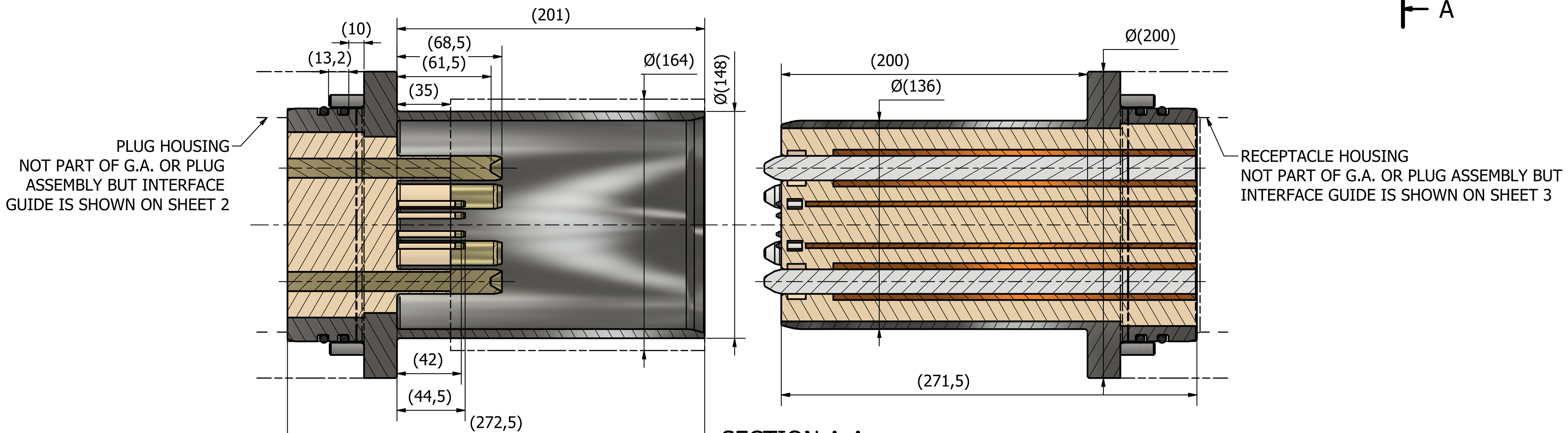
DRAWING NOT TO BE USED FOR MANUFACTURE UNLESS STATE IS "RELEASED".

STATE	SIZE	SHEET	REVISION
Released	A1	1 OF 4	2

ITEM	QTY	PART NUMBER	TITLE	MATERIAL	UNIT MASS
1	1	BF194-0094	PLUG ASSY	SEE ASSY	12.2 kg
2	1	BF194-0093	RECEPTACLE ASSY	SEE ASSY	15.8 kg
3	16	ISO 4762 - M8 x 35	SOCKET HEAD CAP SCREW	A4-80	0.0 kg
4	16	8MM WASHER	8MM WASHER	SS 316L [1.4404]	0.0 kg
5	2	ISO 8739 - 6 x 30	DOWEL PIN	STAINLESS STEEL 316	0.0 kg

CONNECTOR ASSEMBLY; DE-MATED 2





SECTION A-A

NOTES:

1. THE OBJECTIVE OF THIS INTERFACE DRAWING IS TO ENSURE COMPATIBILITY OF A PLUG AND RECEPTACLE MANUFACTURED BY TWO DIFFERENT SUPPLIERS. ANY SUPPLIERS OF THESE CONNECTORS MUST ENSURE COMPLIANCE TO ALL RELEVANT STANDARDS.
2. THE CONNECTOR HAS BEEN SIZED TO ACCOMMODATE UP TO 500kW @1,000VDC SUBJECT TO THE DETAILED DESIGN OF THE CONNECTOR PINS. SEE TABLE 1 FOR MORE DETAILS. THE MAXIMUM STATED CURRENT IS IN RELATION TO THE SMALLEST DIAMETER OF THE MALE PINS IN THE PLUG. THE OVERALL END-TO-END CURRENT RATING OF EACH PIN CIRCUIT WILL DEPEND ON THE SPECIFIC CURRENT RATING OF THE FEMALE CONNECTOR.
3. IT IS RECOMMENDED TO INCLUDE A TEMPERATURE PROBE ON BOTH PLUG AND RECEPTACLE TO MONITOR THE TEMPERATURE RISE DURING CHARGING AND FEED THIS INTO THE CHARGER CONTROL SYSTEM SO THAT THE CURRENT CAN BE LIMITED.
4. SEE SPECIFIC PLUG AND RECEPTACLE NOTES ON SHEET 2 AND 3.
5. GENERAL ASSEMBLY BOM IS INCLUDED ON SHEET 1, AND SUB-ASSEMBLIES BOM IS INCLUDED ON SHEET 2 AND 3. ALSO, HOUSING DETAILS ARE INCLUDED ON SHEET 2 AND 3.

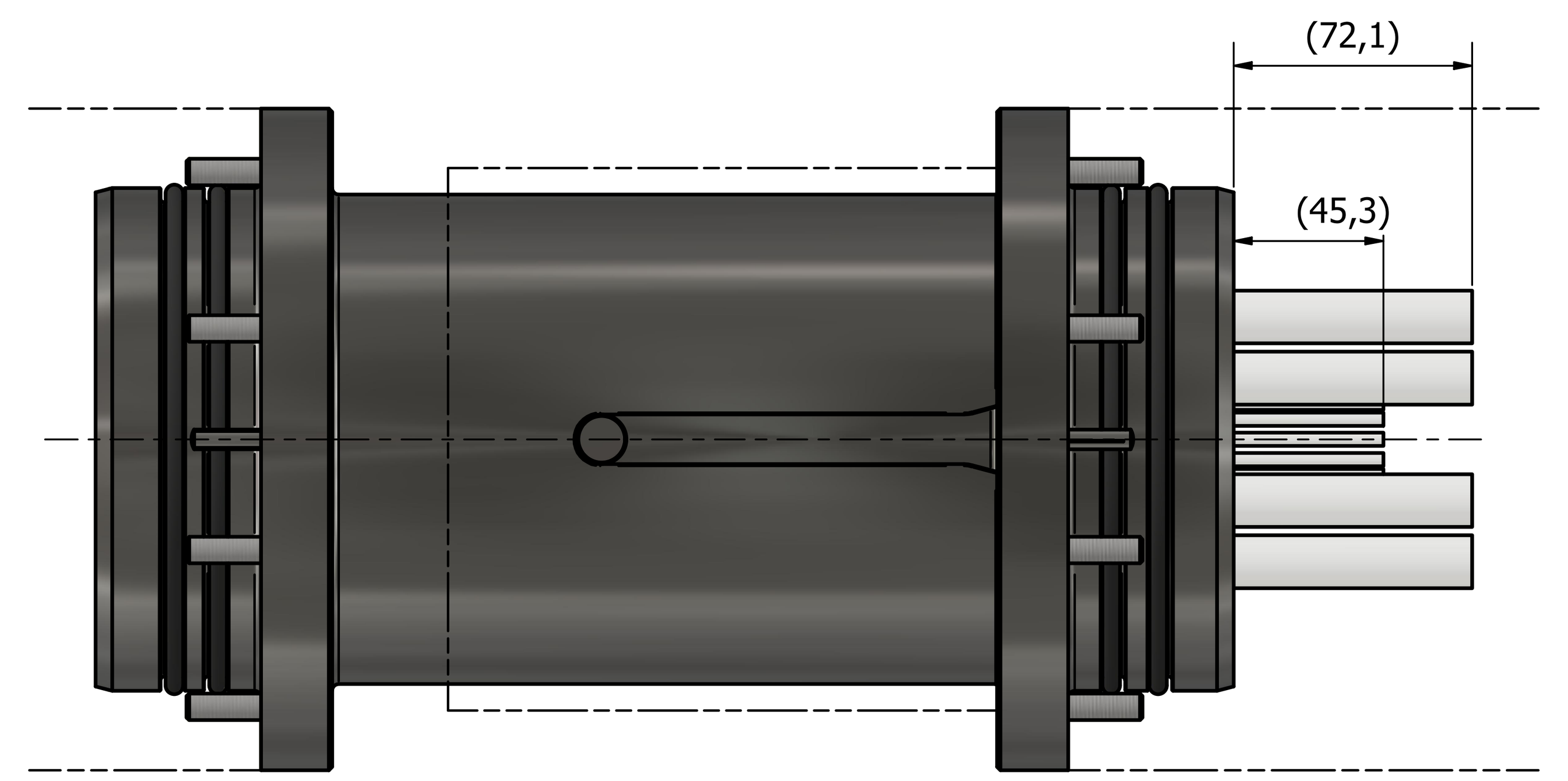
DIMENSIONAL NOTES:

6. DIMENSIONS ON SHEET 1 FOR REFERENCE ONLY. ACTUAL MACHINING DIMENSIONS AND TOLERANCES CAN BE SEEN ON SHEET 2 AND 3.
7. IF TOLERANCE IS NOT PRESENT, SEE GENERAL NOTES FOR GENERAL TOLERANCE IN ACCORDANCE WITH ISO 2768.
8. ALL DIMENSIONS MARKED '*' CAN BE SOLUTION PROVIDER-SPECIFIC, AND IS NOT BOUND BY ANY STRICT REQUIREMENT FOR COMPATABILITY. FOR EXAMPLE, THE HOUSING DESIGN FOR THE PLUG COULD HAVE A MUCH LARGER OUTSIDE DIAMETER THAN THE STATED VALUE FOR THE PLUG CONNECTOR ATTACHMENT FLANGE. IT IS ENVISIONED THAT THE DESIGN OF THE HOUSING WILL INCLUDE MANY ADDITIONAL FEATURES SUCH AS COARSE ALIGNMENT FEATURES, LOCK/SECURE FEATURE, ATTACHMENT OF UMBILICAL CABLE, SEALING AND TESTING PORTS ETC.
9. RADIAL, ANGULAR AND ROTATIONAL MISALIGNMENT IS INCLUDED IN MISALIGNMENT TABLE. FOR THE AVOIDANCE OF DOUBT, MISALIGNMENT VALUES ARE TOTAL VALUES (FROM PLUG TO RECEPTACLE).

SYSTEM INTEGRATION:

10. 'EXTERNAL SPACE ENCLOSURE' IS TO ENABLE OPTIONAL CAPPING ARRANGEMENT OF THE PLUG, WHICH IS RECOMMENDED. THE ENCLOSURE ENABLES THE SEAL OF THE CAP TO TAKE PLACE ON ONE PLANE. THE DESIGN OF THE EXTERNAL SIDE OF THE PLUG WHICH CONTAINS THE CAPPING CAN BE SUPPLIER SPECIFIC, AS LONG AS IT DOES NOT INTERFERE WITH THE MATE AND DE-MATE OF THE PLUG INTO THE RECEPTACLE.
11. DETAILS BEYOND THE PLUG AND RECEPTACLE INTERNALS BOUNDARY IS BEYOND THE SCOPE OF THIS DRAWING, AND THE MANUFACTURER SHOULD USE BEST PRACTICE TO TERMINATE THE CABLES. IT'S RECOMMENDED TO USE AN ADAPTOR FOR THE PLUG AND RECEPTACLE PIN CONNECTIONS SO THAT A RANGE OF DIFFERENT CABLES CAN BE USED TO SUIT THE OVERALL SYSTEM DESIGN.
12. THE RECEPTACLE SHALL BE PLACED ON THE VESSEL, AND THE PLUG SHALL BE ON THE ASSET. THEREFORE, IT IS RECOMMENDED TO POT THE PLUG INTERNALS AFTER CABLE TERMINATION, BUT THIS IS NOT A REQUIREMENT.
13. EACH BOM SPECIFIES RECOMMENDED MATERIALS; HOWEVER, THESE CAN BE SUBSTITUTED FOR SUITABLY QUALIFIED ALTERNATIVES THAT DO NOT HAVE DETRIMENTAL EFFECTS ON PERFORMANCE, AVAILABILITY OR RELIABILITY.
14. PLUG AND RECEPTACLE WILL NEED TO BE EARTHED TO THEIR RESPECTIVE HOUSING VIA A SPECIFIC EARTH MOUNT (DETAIL NOT SHOWN ON THIS DRAWING). THE GENERAL ASSUMPTION IS THAT THE PLUG WILL BE EARTHED TO THE HOUSING, AND TO COMMON-EARTH VIA THE UMBILICAL/CABLE, AND THE RECEPTACLE WILL BE EARTHED TO THE CTV/VESSEL COMMON-EARTH BY MEANS OF A DEDICATED EARTH CABLE. THEREFORE THERE IS NO REQUIREMENT FOR A DEDICATED EARTH PIN INSIDE THE CONNECTOR. THE EGC (EARTH GROUND CONDUCTOR) PROVIDES A LOW IMPEDANCE PATH BETWEEN NORMALLY NON-CURRENT CARRYING METALLIC PARTS. THIS SHALL BE CONNECTED TO PIN 'C0' WITH A RESETABLE ELECTRONIC 2A FUSE PLACED ON THE ASSET.
15. ANY LUBRICATION OF THE PINS BOTH PRIOR TO ASSEMBLY AND IN-SERVICE WILL BE SUPPLIER SPECIFIC, INCLUDING ALL MAINTENANCE PROVISIONS.
16. CONNECTOR CONNECTION TO THE UMBILICAL WILL NEED TO ADHERE TO THE MANUFACTURER'S MINIMUM BEND RADIUS (MBR).
17. IT IS RECOMMENDED TO USE FASTENERS WITH LOCKING MEANS TO CONNECT THE CONNECTOR TO THE HOUSING, IN ORDER TO PREVENT UNWANTED RELEASE.
18. MATING AND DE-MATING CONNECTION SPEEDS WILL BE LIMITED BY SOLUTION PROVIDER.
19. ONCE MATED, AN AXIAL FORCE OF 200N OVER AND ABOVE THE MATING FORCE SHALL BE MAINTAINED TO PREVENT UNWANTED DE-MATING.
20. THE DE-MATED STATE OF THE RECEPTACLE SHOULD NOT CREATE A SHORT-CIRCUIT BETWEEN ANY OF THE PINS.
21. THE CONNECTOR PLUG/RECEPTACLE SHOULD HAVE A SERVICE INTERVAL TARGET OF 1,500 CYCLES BETWEEN SERVICE.

CONNECTOR ASSEMBLY; FULLY MATED 2



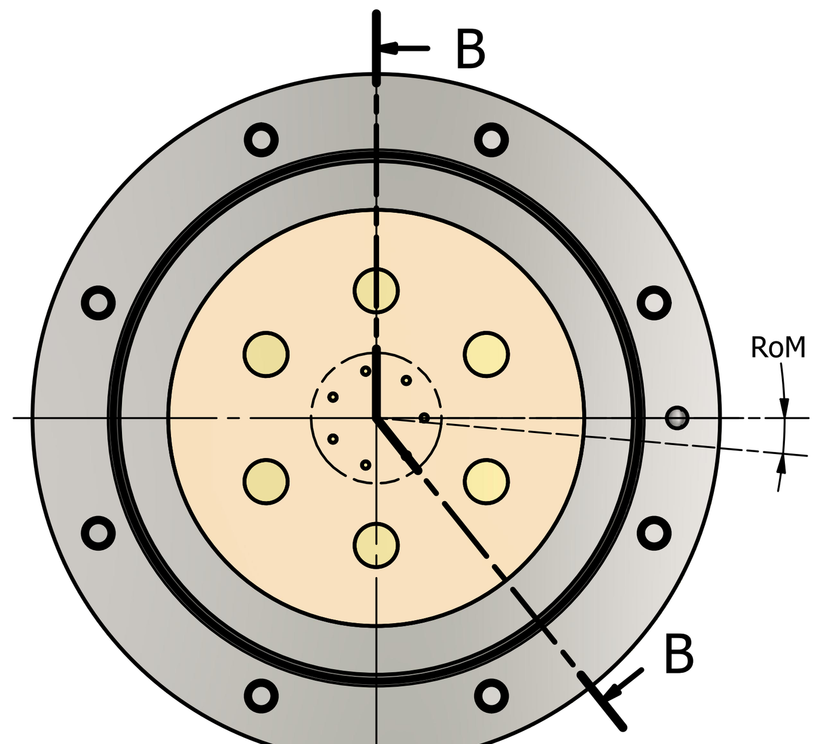
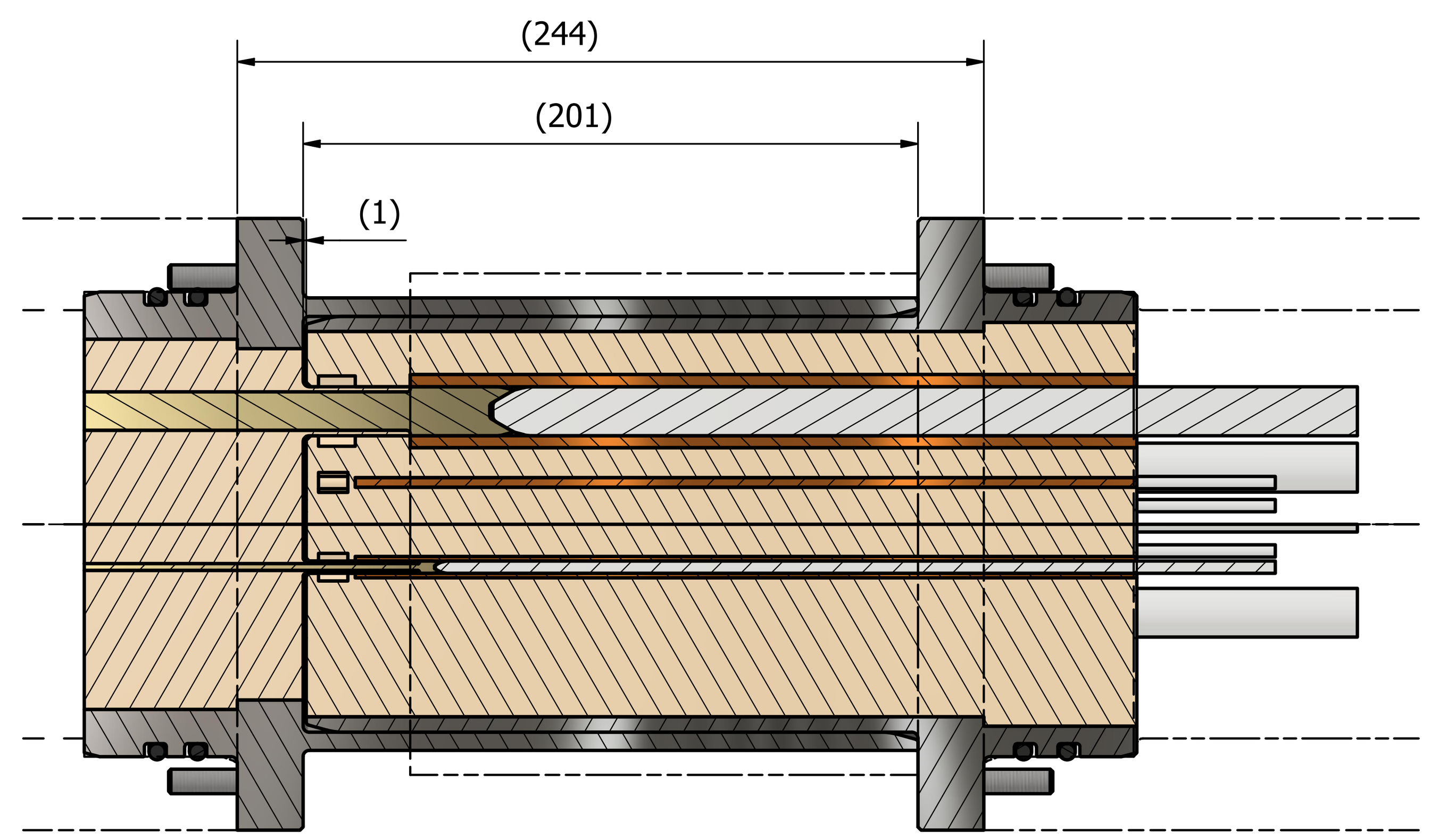


TABLE 1 - PIN DETAILS

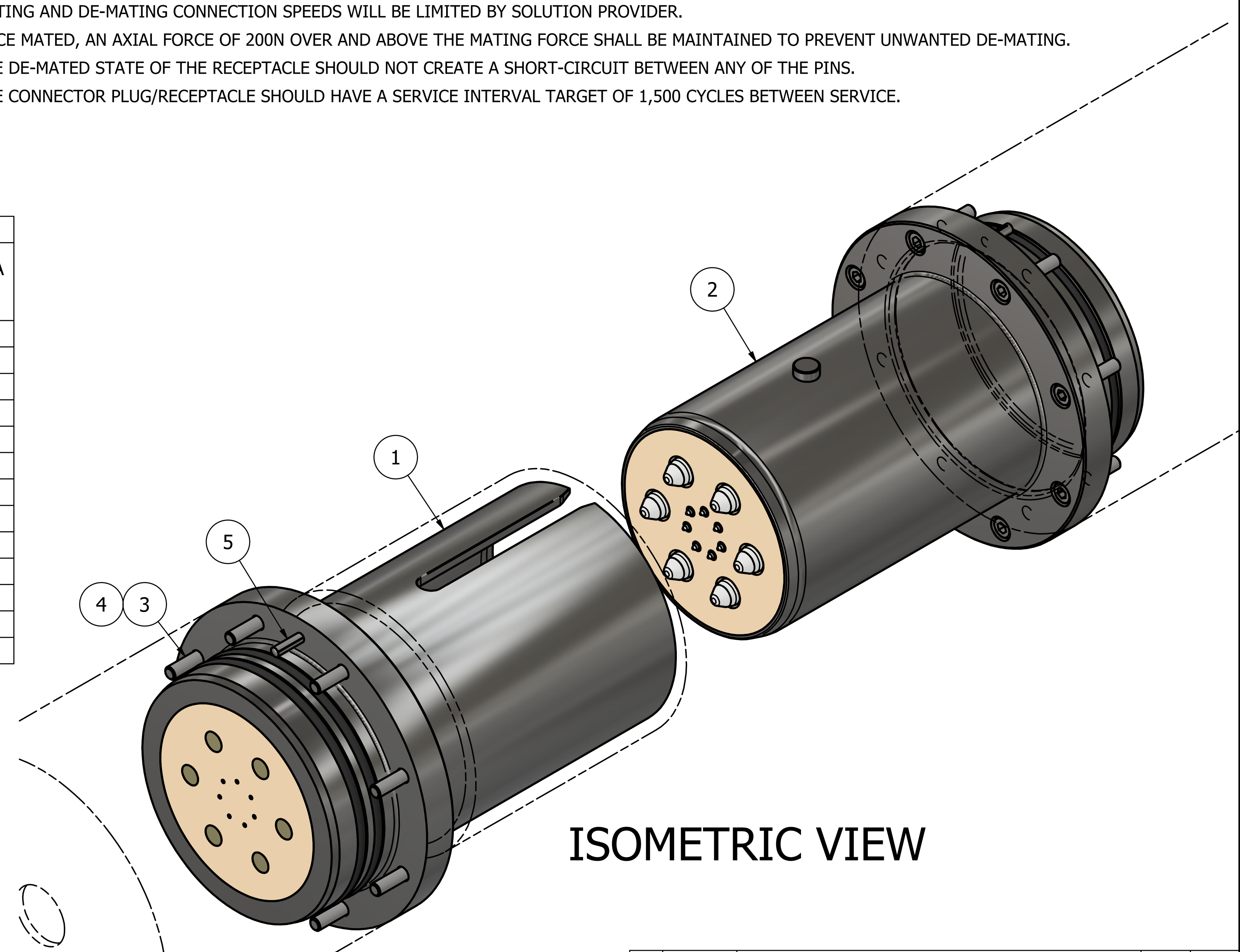
PIN I.D.	DESCRIPTION	MAX VOLTAGE (V)	MAX CURRENT (A)	PIN MIN CSA (mm^2)
P1	POWER +DC1	1,000	199.5	124.7
P2	POWER, +DC2	1,000	199.5	124.7
P3	POWER, +DC3	1,000	199.5	124.7
P4	POWER. -DC1	1,000	199.5	124.7
P5	POWER, -DC2	1,000	199.5	124.7
P6	POWER, -DC3	1,000	199.5	124.7
C0	COMMS 0; EGC	30	2	1.25
C1	COMMS 1; SPARE A	30	2	1.25
C2	COMMS 2; TX DATA+	30	2	1.25
C3	COMMS 3; TX DATA-	30	2	1.25
C4	COMMS 4; SPARE B	30	2	1.25
C5	COMMS 5, RX DATA+	30	2	1.25
C6	COMMS 6, RX DATA-	30	2	1.25



SECTION B-B

TABLE 2 - MISALIGNMENT

DESCRIPTOR	SYMBOL	VALUE	UNIT	LOCATION REF
RADIAL MISALIGNMENT	RaM	4	MM	SHT1-G10
ANGULAR MISALIGNMENT	AM	1	DEG	SHT1-G8
ROTATIONAL MISALIGNMENT	RoM	2.2	DEG	SHT1-C7



ISOMETRIC VIEW

THIS DRAWING IS INTENDED AS AN INTERFACE GUIDE ONLY. IT IS THE RESPONSIBILITY OF THE CONNECTOR DEVELOPER TO ENSURE THAT ANY PRODUCTS THEY DESIGN THROUGH ADOPTING THIS GUIDE MEET ALL APPROPRIATE STANDARDS (ESPECIALLY THOSE RELATING TO SAFETY) AND UNDERTAKE FORMAL QUALIFICATION TESTING. BLACKFISH ENGINEERING DESIGN LIMITED ASSUME NO LIABILITY FOR LOSS OR DAMAGE AS A RESULT OF THE ADOPTION OF THIS GUIDE WITHIN A THIRD PARTY'S CONNECTOR DESIGN.

Machining Tolerance to ISO 2768

Tolerance class		Peremissable deviations for basic size range								Permissable deviations for ranges of lengths in millimetres of shorter side of the angle concerned				
Designation	Description	from 0.5 up to 3	from 3 up to 6	from 6 up to 30	from 30 up to 120	from 120 up to 400	from 400 up to 1,000	from 1,000 up to 2,000	from 2,000 up to 4,000	up to 10	over 10 up to 50	over 50 up to 120	over 120 up to 400	over 400
f	fine	± 0.05	± 0.05	± 0.1	± 0.15	± 0.2	± 0.3	± 0.5	--	± 1°	± 0.5°	± 0.333°	± 0.166°	± 0.083°
m	medium	± 0.1	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2					
c	coarse	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2	± 3	± 4	± 1.5°	± 1°	± 0.5°	± 0.25°	± 0.166°
v	very coarse	--	± 0.5	± 1	± 1.5	± 2.5	± 4	± 6	± 8	± 3°	± 2°	± 1°	± 0.5°	± 0.333°

REV	DATE	DESCRIPTION	BY	APP'D
2	01/10/2024	UPDATED ACCORDING TO C.T. COMMENTS. LARGER CONNECTOR BODY AND SPACINGS, PCD AND POSITIONING	ISM	ISM
1	30/11/2022	INITIAL ISSUE	ISM	TWA

MATERIAL: SEE BOM

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5. IF IN DOUBT, ASK.

BLACKFISH
ENGINEERING DESIGN AND PRODUCT DEVELOPMENT
BLACKFISH ENGINEERING LTD
4 UNITY STREET, BRISTOL, BS1 5HH
ENGLAND +44 1173 138123

MASS : 28.3 kg

DRAWING NO. : BF194-0078

TITLE : CONNECTOR GA

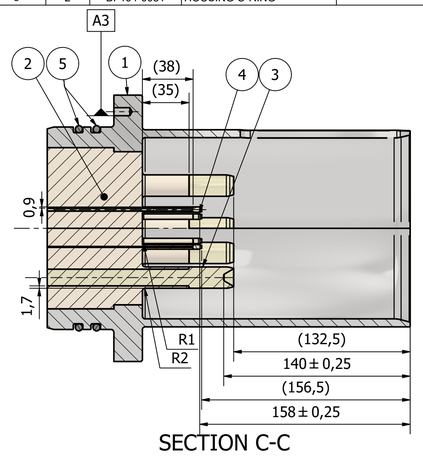
DRAWING NOT TO BE USED FOR MANUFACTURE UNLESS STATE IS "RELEASED".

STATE: Released | A1 | SHEET: 2 OF 4 | REVISION: 2

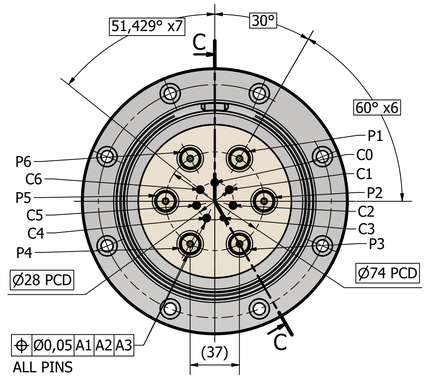
ITEM	QTY	PART NUMBER	TITLE	MATERIAL	UNIT MASS
1	1	BF194-0089	PLUG HOUSING	EN10088 316L [1.4404]	10.0 kg
2	1	BF194-0091	PLUG INNER INSULATOR	PEEK	1.1 kg
3	6	BF194-0090	DC MALE PIN	BERYLLIUM COPPER, GOLD PLATED	0.2 kg
4	7	BF194-0088	COMMS PIN	BERYLLIUM COPPER, GOLD PLATED	0.0 kg
5	2	BF194-0081	HOUSING O-RING	FKM	0.0 kg

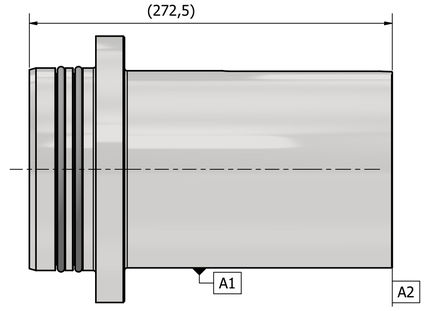
BF194-0094
PLUG ASSEMBLY

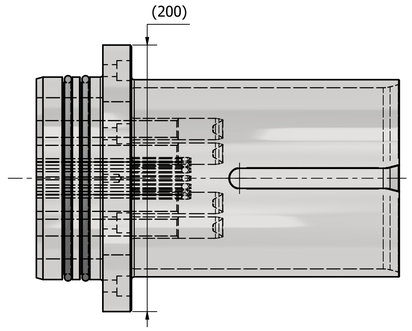
2



SECTION C-C





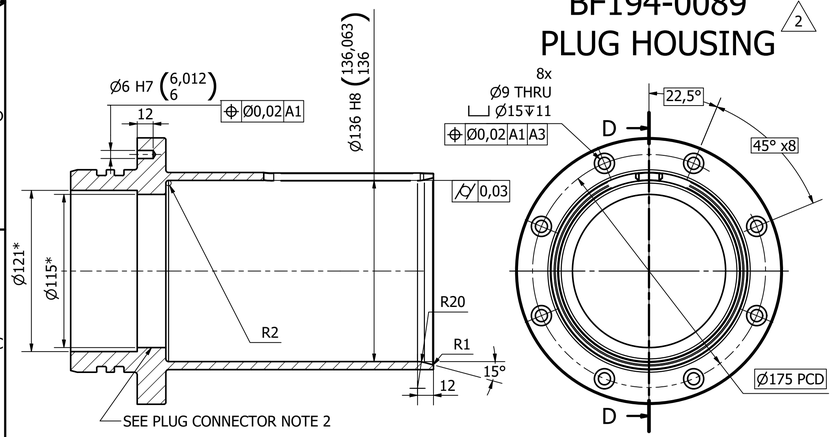


PLUG CONNECTOR:

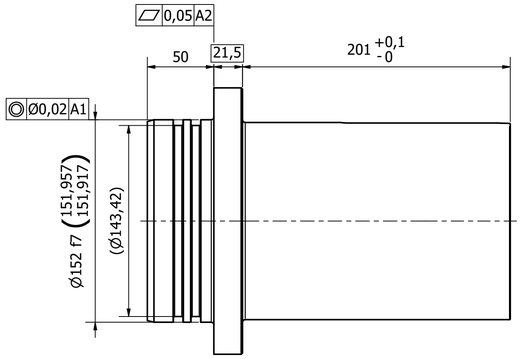
1. PIN CONNECTIONS TO THE CABLES ARE NOT DEFINED IN THIS DRAWING. IT IS SUGGESTED THAT THESE CONNECTIONS ARE MADE TO BEST INDUSTRY PRACTICE IN A 'FIT AND FORGET' APPROACH. IT IS RECOMMENDED THAT THE PLUG CONNECTOR IS POTTED TO MINIMISE LEAKAGE.
2. INCLUDING A REDUCED DIAMETER ON PLUG INTERNAL TO RETAIN BF194-0091 IS RECOMMENDED, BUT OTHER METHODS FOR SECURING THE INSULATION EXIST. IT IS RECOMMENDED TO INCLUDE A SEAL BETWEEN THE OUTER HOUSING AND THE INNER INSULATOR, AS WELL AS BETWEEN THE PINS AND THE INSULATOR.
3. PIN DIAMETERS ARE FINISHED DIMENSION (AFTER COATING AND ANY HEAT TREATMENT).
4. HOUSING INTERNAL DEPTH IS A MAXIMUM SPACE ENVELOPE DIMENSION TO ENABLE WIDER SYSTEM INTEGRATION.
5. CONNECTOR TERMINALS MUST BE LABELED ON INTERNAL SIDE AS SHOWN IN AREA 'G9'.

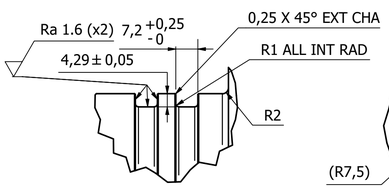
BF194-0089
PLUG HOUSING

2

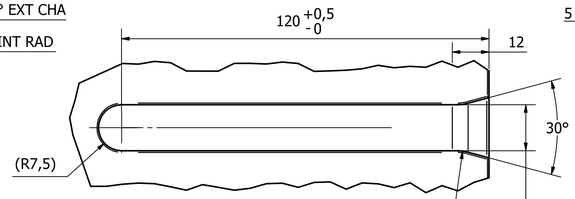


SECTION D-D

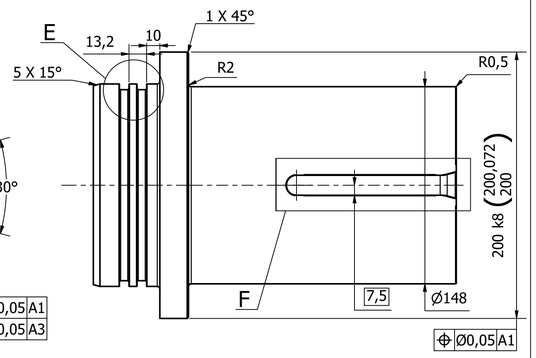




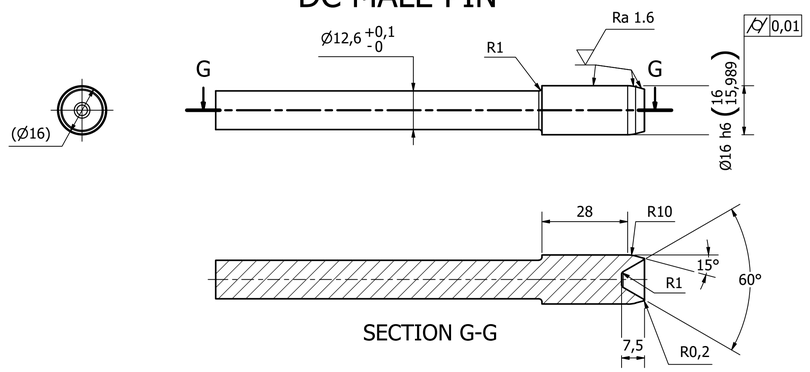
DETAIL E
TYPICAL O-RING GROOVE DETAIL TO ISO3601
(OR CAN BE OTHER STANDARD IF COMPATIBLE WITH PLUG HOUSING BF194-0092)



DETAIL F

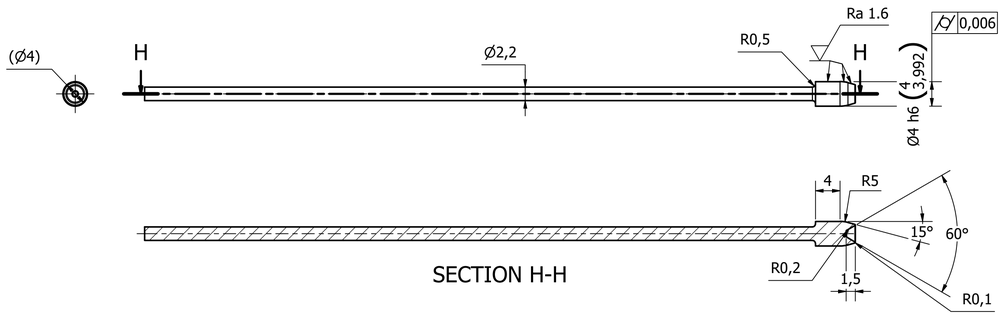


BF194-0090
DC MALE PIN



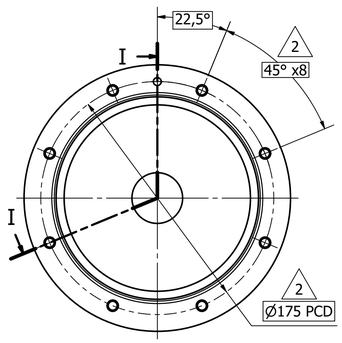
SECTION G-G

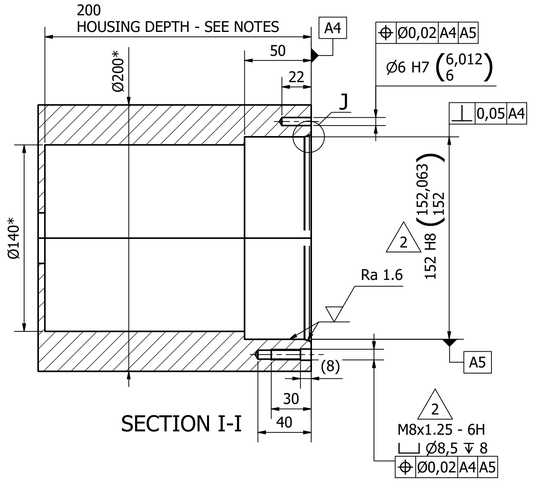
BF194-0088
COMMS PIN



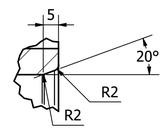
SECTION H-H

BF194-0092
PLUG HOUSING SPACE ENVELOPE





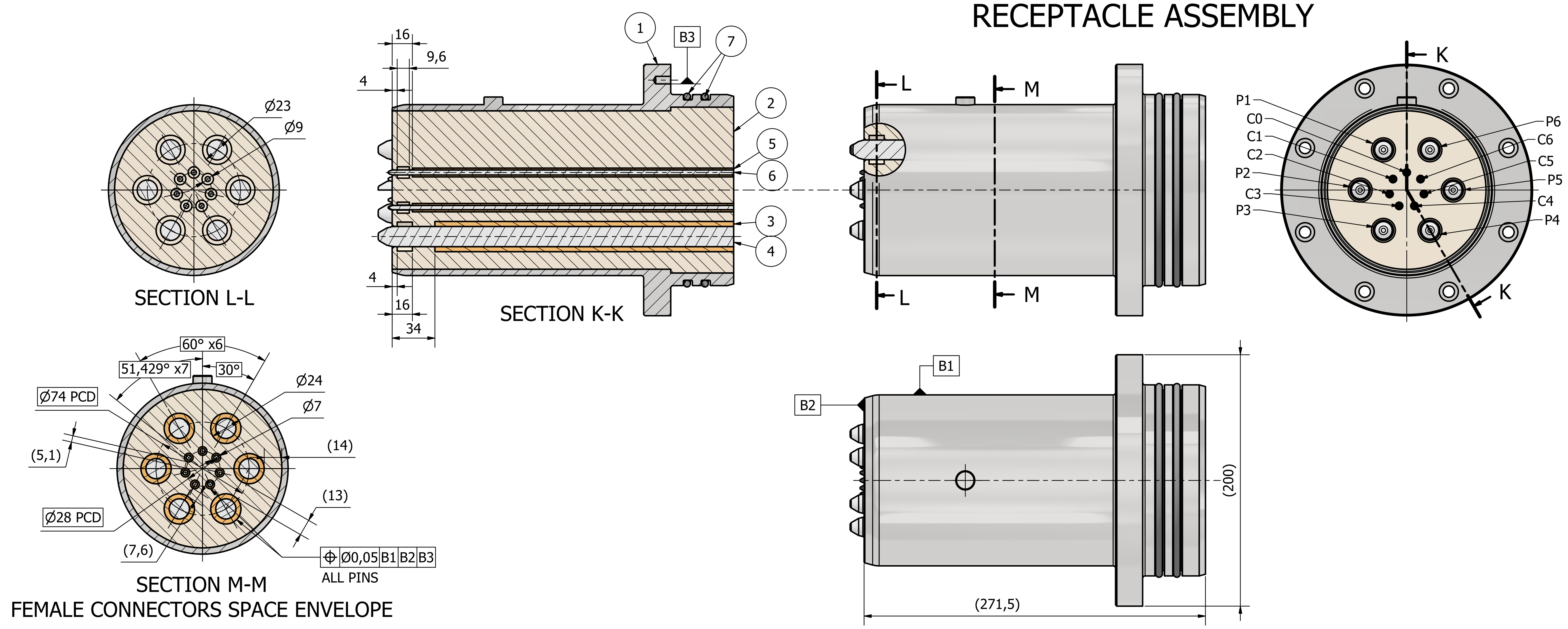
SECTION I-I



DETAIL J

MATERIAL: SEE BOM	BLACKFISH BLACKFISH ENGINEERING LTD 4 UNITY STREET, BRISTOL, BS1 5HH WWW.BLACKFISH.ENGINEERING	MASS : 28.3 kg	DRAWING NO. : BF194-0078		
GENERAL NOTES: 1. ALL DIMENSIONS IN MM UNLESS OTHERWISE STATED. 2. DEBURR AND BREAK SHARP EDGES. 3. DO NOT SCALE FROM DRAWING. 4. ALL TOLERANCES TO ISO-2768-mK UNLESS OTHERWISE SPECIFIED. 5. IF IN DOUBT, ASK.			TITLE : CONNECTOR GA		
			DRAWING NOT TO BE USED FOR MANUFACTURE UNLESS STATE IS "RELEASED".	STATE Released	A1 / SHEET 3 OF 4 / REVISION 2

BF194-0093 RECEPTACLE ASSEMBLY



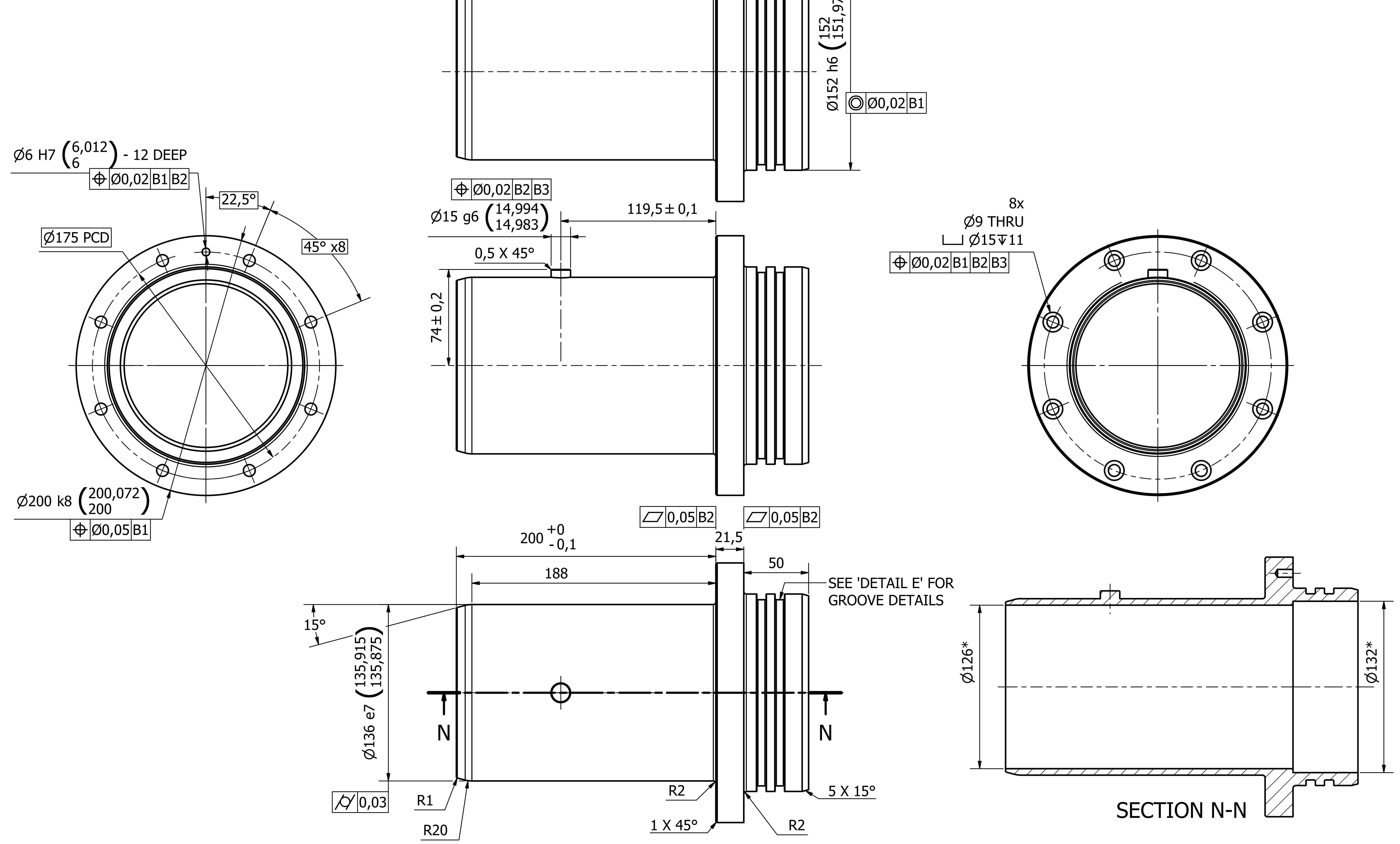
RECEPTACLE BILL OF MATERIALS

ITEM	QTY	PART NUMBER	TITLE	MATERIAL	UNIT MASS
1	1	BF194-0085	RECEPTACLE HOUSING	EN10088 316L [1.4404]	7.9 kg
2	1	BF194-0082	RECEPTACLE INNER INSULATOR	PEEK	3.7 kg
3	6	BF194-0084	DC FEMALE PIN	BERYLLIUM COPPER, GOLD PLATED	0.5 kg
4	6	BF194-0086	DC DUMMY PIN	CERAMIC	0.1 kg
5	7	BF194-0083	COMMS FEMALE PIN	BERYLLIUM COPPER, GOLD PLATED	0.1 kg
6	7	BF194-0087	COMMS DUMMY PIN	CERAMIC	0.0 kg
7	2	BF194-0081	HOUSING O-RING	FKM	0.0 kg

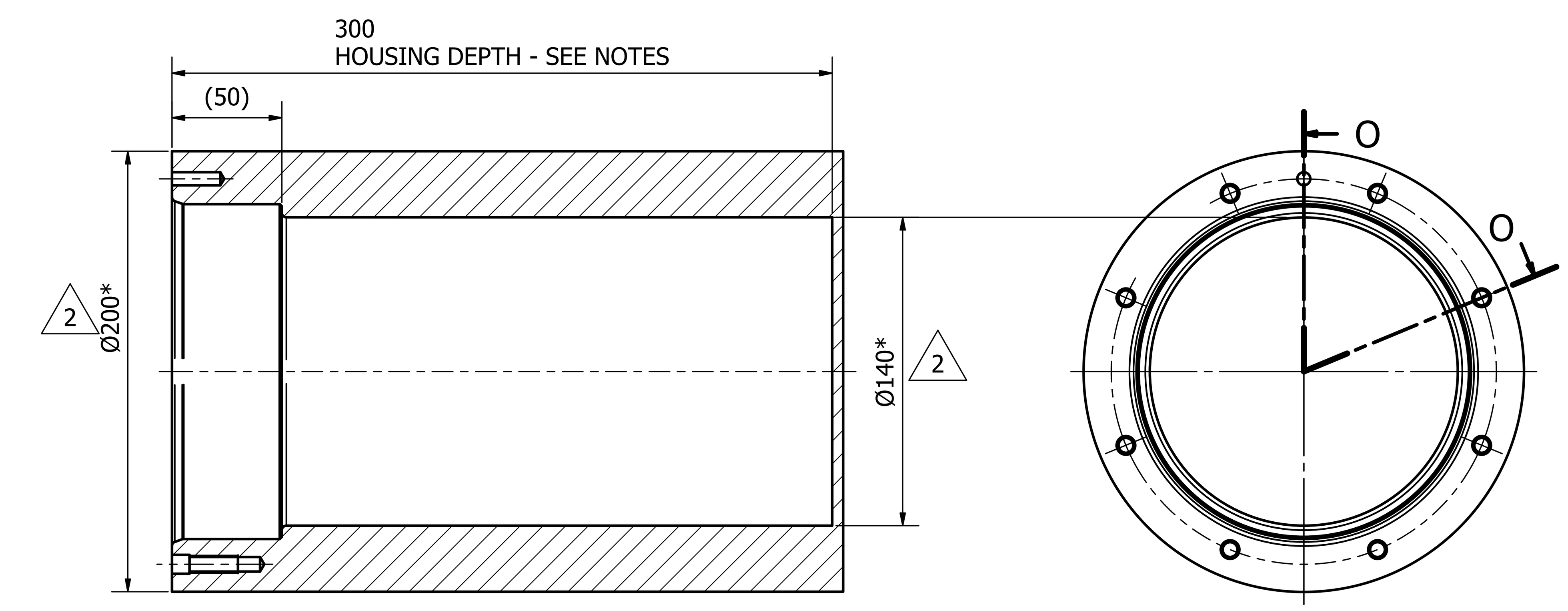
RECEPTACLE CONNECTOR:

1. ANTI-ROTATIONAL FEATURE DOES NOT NEED TO BE CIRCULAR, AND CAN BE LONGER AXIALLY TOWARDS THE MOUNTING FLANGE IF NEEDED, BUT IT MUST NOT AFFECT THE MATED AND DE-MATED POSITIONS.
2. FEMALE CONNECTOR FOR DC AND COMMUNICATIONS ARE SUPPLIER SPECIFIC, AND THE SOLUTION PROVIDER WILL NEED TO ENSURE ADEQUATE CONTACT PRESSURE ON THE MALE PIN CONNECTORS TO LIMIT EXCESSIVE THERMAL INCREASE INSIDE THE CONNECTOR DURING POWER TRANSFER.
3. PEEK INSULATION SHOULD BE USED BETWEEN ALL EXPOSED COPPER PINS THAT DO NOT ADHERE TO A MIN PROXIMITY DISTANCE OF 1.5D.
4. RECEPTACLE HOUSING SEALING FACES AND BOLT/DOWEL ARRANGEMENT IS IDENTICAL TO THE PLUG. THE HOUSING DEPTH IS LARGER FOR THE RECEPTACLE TO ALLOW FOR THE INCREASED COMPLEXITY. AS PER PLUG HOUSING, HOUSING INTERNAL DEPTH IS A MAXIMUM SPACE ENVELOPE DIMENSION TO ENABLE WIDER SYSTEM INTEGRATION.
5. RECEPTACLE CONNECTOR CONTAINS DUMMY PLUGS AS SHOWN (ITEM 4 AND 6). THE DIMENSIONS OF THE DUMMY PINS WILL BE SUPPLIER SPECIFIC DUE TO THE FEMALE CONNECTOR ARRANGEMENT, AND THE SEALING REQUIREMENTS. IT IS RECOMMENDED TO USE SPRINGS TO MAINTAIN THE DE-MATED POSITION OF THE DUMMY PINS IN ORDER TO KEEP THE SEALS ACTIVE. THE SEALS ARE NOT SHOWN, BUT A SPACE ENVELOPE HAS BEEN ALLOWED FOR SHOWN IN SECTION K-K, AND L-L, THAT IS BASED ON OVERSIZED O-RINGS TO BS3601. THE DUMMY PINS (AND ANY SPRINGS) HAS TO FIT WITHIN THE BOUNDARY OF THE HOUSING SPACE ENVELOPE IN THE MATED AND DE-MATED POSITONS.
6. CONNECTOR TERMINALS MUST BE LABELED ON INTERNAL SIDE AS SHOWN IN AREA 'G5'.

BF194-0085 RECEPTACLE HOUSING



BF194-0080 RECEPTACLE HOUSING SPACE ENVELOPE



SECTION O-O

MATERIAL:	SEE BOM
MASS :	28.3 kg
DRAWING NO. :	BF194-0078
TITLE :	CONNECTOR GA
STATE	Released
SIZE	A1
SHEET	4 OF 4
REVISION	2

DRAWING NOT TO BE USED FOR MANUFACTURE UNLESS STATE IS "RELEASED".

GENERAL NOTES:

1. ALL DIMENSIONS IN MM UNLESS OTHERWISE STATED.
2. DEBURR AND BREAK SHARP EDGES.
3. DO NOT SCALE FROM DRAWING.
4. ALL TOLERANCES TO ISO-2768-mK UNLESS OTHERWISE SPECIFIED.
5. IF IN DOUBT, ASK.

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