

8	7	6	5	4	3	2	1
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HOLE / FEATURE SCHEDULE (θ from the top pole; AZ 0° = DN80 flow-run direction)

REF	QTY	SIZE	COMPONENT	POSITION	NOTES
H1	1	Ø90 +1/−0	Top cap	Centre, crown θ=0°	Crown port. Riser machined flush; structural + seal weld u/side (SH03 D1). POS Ø3.0 [A]B
H2	1	Ø90 +1/−0	Bottom cap	Centre, pole θ=180°	Riser exit. Ø110 +1/−0 bellows boss over it — NO WELD TO THE PIPE (SH03 D2)
H3	2	Ø10	Bottom cap	PCD Ø150 @180°	Weep telltales — discharge visibly into the skirt / chamber
H4	2	Ø10	Shell, vents	Z=450, θ=123.4°, AZ 90°/270°	Drill radial; deburr and polish edges
H5	9	SLOT 9 × 18	Stay tabs	Z=600/1200/1800, AZ 0/120/240°	M8 rod end, ±5 adjust (SH03 D3)
H6	6	OBROUND 24 × 30	Base flange	PCD Ø800, AZ25 + 60°	Over M16 × 400 CRC-V cast-in studs (SH04, SH07)
H7	3	M20 × 2.5	Base flange	PCD Ø700, AZ30/150/270°	Jacking screws, 17 mm hex socket drive — remain live and locked
H8	4	M20 × 30 BLIND	Base flange	PCD Ø800, AZ 35/125/215/305°	Lifting bosses. Plug with CRC-V + epoxy after the lift
H9	2	Ø16.5 +0.2/0	Base flange	PCD Ø720, AZ 65°/245°	Guide dowel bushes — one round, one radially slotted 16.5 × 20
H10	4	Ø12	Base flange	r310, AZ 15/105/195/285°	Grout injection ports, vents at the flange ID
H11	4	Ø80	Base flange	r345, AZ 45/135/225/315°	Clearance for the Ø60 tray-support posts — NO CONTACT
H12	8	60 × 40, R10	Skirt	45° pitch, sill at −415	Drain slots to a local sump; edges deburred, Ra ≤0.8
H13	1	Ø50	RC pad	At the skirt low point	Sump drain through the pad
H14	1	M12 × 1.5	Skirt wall	Above the standing-water line	Desiccant / moisture-trap breather boss, out of the runoff path
H15	1	Ø20	Interior low point	Reached from the chamber	CRC-V seal-welded boss + removable drain plug

ALL HOLE EDGES DEBURRED AND POLISHED — WATER FILM FLOWS OVER THEM. THE REV C ANCHOR-LUG HOLES (3× Ø14 AT PCD Ø700) AND THE M10 RING LIFT BOSSES ARE DELETED.

TOLERANCE & FIT REGISTER

ITEM	TOLERANCE / FIT
Sphere R_OUT	1000 ±3.0 (profile of surface 6.0 [A]B)
Local waviness	≤0.5 per 100
Welds ground flush	≤0.2 proud after weld; ≤0.03 before polish (Q11); re-polished to match
Crown weir level	±0.5 machined + ±0.5 site-set = ±1.0 TOTAL
Crown dish (SH03 D1)	flush to shell O/S ≤0.1; profile 0.5 [A]B
Riser holes H1 / H2	Ø90 +1/−0; position Ø3.0 [A]B
Riser verticality	≤1:500 over 2398 (⊥ Ø2.0 [A])
Doubler collar (internal)	gap ≤0.5 pre-weld; taper start ±2; concentricity ±1.5
Skirt	Ø600 mean ±0.5; OD 610 / ID 590; roundness ≤1.0 TIR; height 446 ±1.0
Skirt cope to shell	match-machined to the AS-BUILT cap; blue-bed ≥70 %
Flange central access	Ø500 ID; skirt lands on the flange annulus — NO SKIRT BORE
Base flange	OD/ID ±1.5; FLATNESS ≤1.0 over Ø940 POST-WELD; level ±2.0
Anchor slots H6	24 +0.2/0 × 30 +0.3/0 → tangential ±4.0, radial ±7.0
Cast-in studs	position ±1.5; plumb ≤1:200; projection ≥60 above the flange
Guide dowels H9	Ø16.5 +0.2/0 → radial 0.25–0.35 (round bush)
Cast-in embed ring	top face level ±3.0 over Ø940; plan ±5.0
Epoxy grout bed	22.5 ±12 (product window 10–250)
Conditioner cartridge	Ø82.0 f8 in Ø82.8 H9 → radial 0.42–0.49, FKM O-ring sealed
Bellows boss	Ø110 +1/−0 over Ø88.9 → radial 10.55–11.05
Pebble trays	top −10 ±1; segment gap 2 ±1; frame-to-rebate 3
Reveal collar	4 ±2 to the as-built shell, SITE-SCRIBED
Skirt O/S to tray ring	25 CLEAR (r305 → r330) — do not reduce
General UNO	ISO 2768-mK: linear ±1.5, angular ≤0.5°

WELD SPECIFICATION

- EN 1090-2 EXC2. WPS QUALIFIED TO ISO 15614-1; WELDERS QUALIFIED TO ISO 9606-1 for the position and material group; both certificates submitted and accepted BEFORE any production weld. Quality level ISO 5817 B on visible shell butts, C elsewhere.
- WPS-01: GTAW, ER316L, full fusion, argon back-purge — all butts.
- Shell butts: square groove both sides or single-V 60° (SH02).
- SKIRT TO SHELL: CONTINUOUS 4.5 mm leg fillet (a = 3.2) BOTH SIDES. Pulsed GTAW ≤0.8 kJ/mm, 100 mm back-step alternating sides, internal copper chill, no coincident start/stops, post-weld fairness ≤0.5 per 100. INTERMITTENT / STITCH WELDS ARE PROHIBITED.
- Crown port: structural + seal weld all round, u/side of the top cap. It is the SOLE structural connection of the riser.
- Bottom pole: seal welds at the bellows only. NO WELD BETWEEN THE RISER AND THE BOTTOM CAP.
- Filletts UNO: doubler edge 5; stay rod-collar 3; tab-shell 3; bosses 3.

BILL OF MATERIALS

IT	MARK	DESCRIPTION	MATERIAL	QTY	MASS
1	P-01a/b/c	Shell gores + polar caps, t5, R1000 O/S	316L / 1.4404	12 + 2	499.0 kg *
2	P-02	Internal doubler collar t8, r242 → 358	316L / 1.4404	1	10.7 kg
3	P-03	Support skirt Ø600 mean × 446 × 10	316L / 1.4404	1	66.2 kg
4	P-04	Base flange OD940 / ID500 × 25	CRC-V 1.4529	1	91.8 kg
5	P-05	Cast-in embed ring OD940 / ID560 × 20	Duplex 1.4462	1	69.7 kg
6	P-06	Anchor studs M16 × 400, nuts, washers (100 % spares)	CRC-V / 1.4462	6 + 6	—
7	P-07a/b	Guide dowels Ø16 h9 ×2 / jacking screws M20 ×3 + pads	Duplex / CRC-V	1 set	—
8	P-08/08b/10	Riser DN80 2398 + bellows + conditioner cartridge	316L / A312	1 ea + spares	19 kg
9	P-15a/b/c	Stay rods Ø10 ×9, collars ×3, tabs ×9	316L / A4	1 set	3 kg
10	P-11-14	Pebble trays, posts, support ring, reveal collar	316L	3.162 m²	—
11	—	Epoxy grout ≥80 MPa chloride-free + anti-seize	ASTM C881 / PTFE	~12 L	—
12	—	ER316L, argon, dye-pen kit, passivation gel	consumables	lot	—

* CAD SHELL MASS AFTER PENETRATIONS. ITEMS 1-4 = 667.7 kg; D.2 STRUCTURAL STEEL SUBSET = 669.6 kg. DRAINED INSTALLED ASSEMBLY INCLUDING INTERNALS = APPROX. 695 kg = 6.82 kN.

LOAD SCHEDULE — REV E

ACTION	VALUE	POINT OF APPLICATION
G — permanent	6.82 kN (695 kg)	Drained assembly, at the axis
W_x — wind, horizontal	780 N	z = +1000 (sphere centre)
W_z — wind, uplift	2340 N	z = +1000, vertically up
Abuse, horizontal	1.5 kN	Any point on the shell
Abuse, vertical	1.0 kN	Any point on the shell
ΔT wet / dry	30 K	Across the film front
ΔT riser / shell	15 K	Over 2400 of riser
Surge (Joukowsky)	240 kPa	Riser and elbow

G = 6.82 kN IS CAD-VERIFIED AND INTEGRATED AT REV E. THE DOUBLER

COLLAR IS A 0.229 m² SPHERICAL ZONE = 10.7 kg, NOT 47.7 kg. LESS RESTORING

WEIGHT IS THE UNCONSERVATIVE DIRECTION FOR UPLIFT — SEE STABILITY.

WIND BASIS — INFERRED

- THE DESIGN WIND IS AN INFERENCE, NOT A CODE VALUE. It is pending the official "Basic wind speed chart — Maldives" called up by Maldives Building Code Cl. B1 (2007) → BS 6399-2:1997, which has not been obtained. Confirm the atoll and the cyclone zone before issue.
- c_f,x = 0.20 — SUPERCRITICAL, at Re = ρVD/μ = 5.55 × 10⁶ (EN 1991-1-4 Fig. 7.30). c_f,z = +0.60.
- c_f,x = 0.50 IS THE SUBCRITICAL VALUE, valid only for Re ≤ 1 × 10⁶ (V ≤ 0.75 m/s). IT MUST NOT BE PAIRED WITH A 45 m/s DYNAMIC PRESSURE — that state is physically unreachable and inflates the design drag 2.5×.
- Envelope q = 0.613 × 45² = 1241 Pa on A_ref = mb²/4 = 3.1416 m².

STABILITY — EN 1990 EQU (γ_G, stb 0.90 / γ_Q, dst 1.50)

CHECK	VALUE	STATUS
EQU, M_dst,d / M_stb,d	0.186 at G = 6.82 kN	PASS
Sliding utilisation	0.112 at G = 6.82 kN	PASS
Bearing q_max	12.4 kPa vs 100–150 allowable	PASS
Settlement, total	0.96 mm (≈0.3 differential)	PASS
Anchor T_max, unfactored	730 N/anchor, approx. 1.3 % utilised	PASS

OVERTURNING TAKEN ABOUT THE PAD UNDERSIDE (−850), LEVER 1.850 m.

BASE DESIGN IS NOT RESTRAINED AGAINST FULL-SUBMERGENCE INUNDATION — SEE SH06.

BOLT TORQUE AND SEQUENCE — 6 × M16 CRC-V

PASS	TORQUE	PATTERN / TIMING
1	30 N·m (33 %)	Cross pattern 1-4-2-5-3-6
2	60 N·m (67 %)	Same pattern
3	90 N·m ±10 %	Same pattern, calibrated wrench
R1	Re-check 90 N·m	After the 7-day epoxy grout cure
R2	Re-check 90 N·m	At the 30-day weir level re-check
R3	Re-check 90 N·m	At 12 months, then every 5 years

- Halogen-free, metal-free anti-seize (PTFE or ceramic — copper and nickel pastes are prohibited). Duplex 1.4462 nuts against CRC-V studs to defeat galling. F = T/(K·d) = 28.1 kN per anchor at K = 0.20; state the band honestly, K = 0.20 ±35 % → 18–38 kN. The design is insensitive across it.
- DO NOT specify F959 DT1 washers or bolt elongation — neither exists or is measurable at this load (0.02 mm).
- Record every bolt. Retain the wrench calibration certificate.

DESIGN WORKING LIFE AND RELIABILITY

· DESIGN WORKING LIFE 50 YEARS · CONSEQUENCE CLASS CC2 (EN 1990) · EXPOSURE XS3 BURIED / XS1 EXPOSED · ISO 9223 CORROSIVITY C5-CX.

REV	DATE	DESCRIPTION	BY
D	2026-08-05	CONCEALED SKIRT ANCHORAGE, RESERVOIR + PLANT, PEBBLE COLLECTOR	NX
E	2026-08-20	REV D.2 ALIGNMENT + VISUAL QA CORRECTIONS	NX
F	2026-09-03	LOGO ENGRAVING ADDED (SH15); SHEET COUNT 14 -> 15	NX
G	2026-09-05	AUDIT CLOSE-OUT: CART Ø82 f8, SLOT 24, 24 TRAYS, DN80	NX
G.2	2026-09-06	PART DRAWINGS SH30-38; SLOTS AZ22.5; DOUBLER R995	NX
G.3	2026-09-06	SH37 BRACKET, SH42 WELD MAP, P-16 BELLOW; IFF	NX

SPA FOUNTAIN — B7 SPA, MALDIVES

SPA-F-SH05 — SCHEDULES — HOLES, TOLERANCES, FINISH, WELDS, BOM

DRAWN: NaXief Eng.		CHECKED: NX 2026-09-06		APPROVED: I. NAZEEF 2026-09-06		STATUS: IFF REV G.3			
DATE: 2026-09-06		REV: G.3		UNITS: mm		SCALE: AS NOTED		A3 · SHEET 5/25	
ISSUED FOR FABRICATION — REV G.3 · HOLD POINTS PER SH42									
WORK TO FIGURED DIMENSIONS · ISO 2768-mK U.O.S.									



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