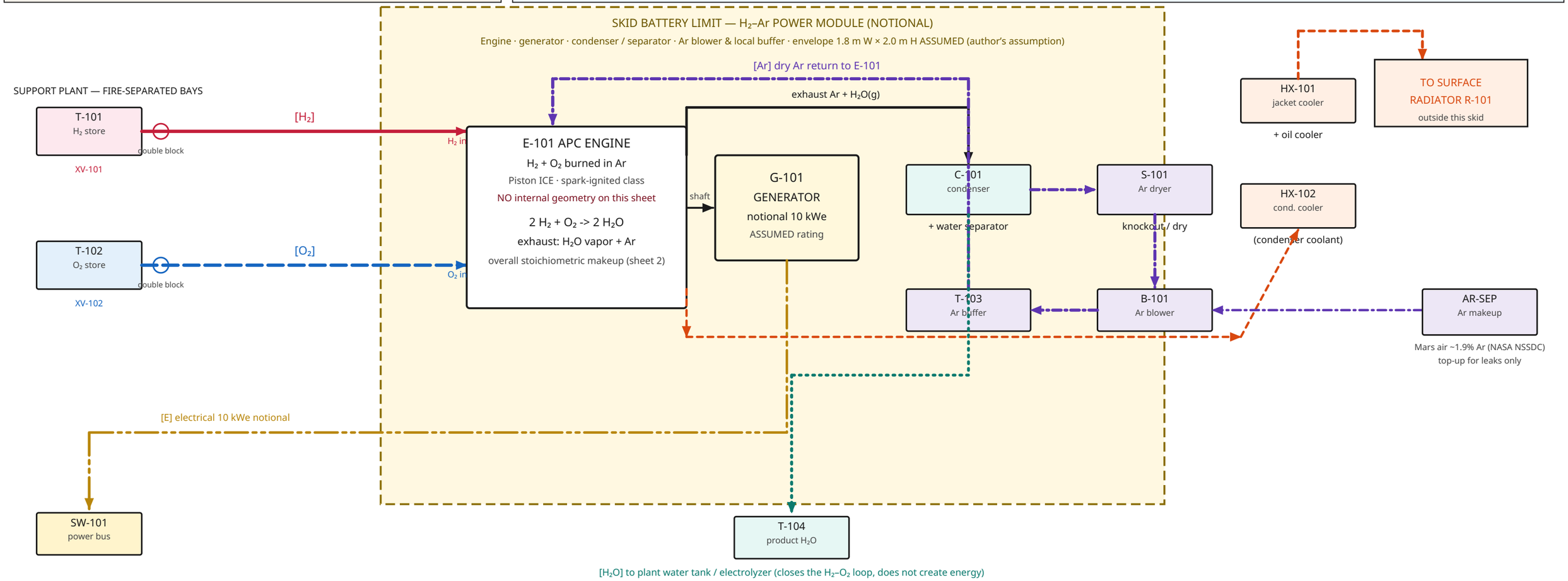
PRELIMINARY CONCEPT — NOT FOR FABRICATION · NOT A CERTIFIED DRAWING · NO BORE / STROKE / RPM / ALLOY / MAWP SHOWN

LINE LEGEND (line style + tag; colour is secondary)

- [H_2] H_2 fuel, solid heavy line
- [O_2] O_2 oxidizer, long dashes
- [Ar] Ar recycle, dash-dot
- [H_2O] Product water, dots
- [CL] Coolant to radiator, short dashes
- [E] Electrical, long-dot-dot dashes

CYCLE: closed-loop piston Argon Power Cycle (APC). 2 H_2 + O_2 -> 2 H_2O burned in recycled argon (γ 1.67). Argon is a working fluid, not a fuel; H_2 needs O_2 to burn.
A stationary generator in an underground equipment room: not a rocket engine, not a dam turbine. A closed external-heat Brayton loop (e.g. He–Xe) is a different machine.

This is energy storage, not an energy source (round trip ~30%, calculated).
Open question: why an engine instead of a fuel cell or batteries? Candidate reasons, UNVERIFIED: no platinum-group catalyst in the engine; repairable with ordinary machine-shop skills; usable waste heat; possibly lower cost. Against: moving parts, parasitic loads, no 10 kW APC unit known to exist. No head-to-head comparison has been done.



NOTES — SHEET 1

1. Cycle follows published Argon Power Cycle research (Noble Thermodynamic Systems; UC Berkeley; Tongji University; others, see sheet 2). Earth lab/field engines are not Mars-rated.
2. Component tags are functional. This sheet does not specify cylinder count, bore, stroke, compression ratio, rpm, ignition timing, materials, setpoints, or relief-valve sizes. Those require licensed design.
3. H_2 and O_2 bulk storage sit in separate fire-rated bays (see sheets 3 and 4). Double-block isolation shown conceptually as XV-101 / XV-102. Oxygen-compatible materials are required on the O_2 train (NASA-STD-6001B practice).
4. Condenser must remove water without freezing the argon loop. Drying/knockout (S-101) costs heat rejection and a small parasitic load. Incomplete drying returns wet Ar and cuts efficiency / risks ice.
5. Generator rating 10 kWe is the author's ASSUMPTION for one notional module. It is not a vendor nameplate and not a measured value.
6. Electrical output goes to the base bus. The engine cannot start the ice-melt or electrolysis chain: independent power (fission or solar, assumed) must exist first.

PROJECT	TITLE	DWG NO.	REV	SHEET
Independent Mars concept: stationary power module H_2–O_2–Ar piston power module · underground equipment room Closed-loop Argon Power Cycle (APC) piston engine · stationary power + water, not propulsion	Process flow — H_2–Ar power module (APC) Units: SI (m, kg/h, kW, kPa). Argon is working fluid, not fuel.	MPM-001 DATE 2026-11-19 Bryan Adams, independent concept, Tacoma WA · Not affiliated with any agency or company · Do not fabricate	B SCALE NTS	1 of 4

PRELIMINARY CONCEPT — NOT FOR FABRICATION · NOT A CERTIFIED DRAWING · NO BORE / STROKE / RPM / ALLOY / MAWP SHOWN

Bookkeeping case: 10 kWe out at 50% LHV-to-electric (ASSUMED, author's assumption). Flows CALCULATED by the author from standard heats of combustion of H_2. Not a measured efficiency.

Published Earth lab results are INDICATED efficiencies, not electrical, and are not used as ratings here: Tongji Univ. preprint net 69.8% / gross 64.4% (SSRN 5105486); Processes 2023, 11(6) gross up to 59.4%; Killingsworth/Dibble 44.1%. Electrical output is lower.

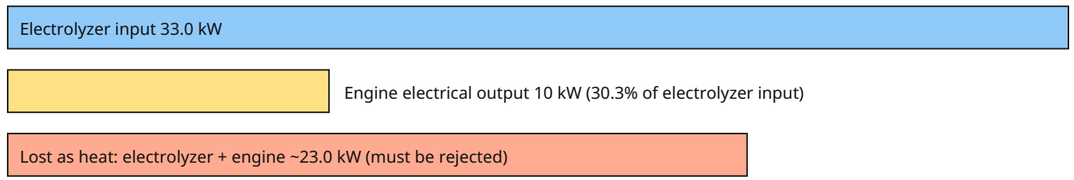
CALCULATED BALANCE (one module, continuous)

Item	Value	Kind
Electrical output We	10 kWe	ASSUMPTION
LHV-to-electric η	50 %	ASSUMPTION
Fuel thermal input (LHV)	20.0 kW	CALCULATED
H_2 LHV	33.322 kWh/kg	SOURCED
H_2 HHV	39.386 kWh/kg	SOURCED
H_2 mass flow	0.600 kg/h (14.40 kg/d)	CALCULATED
O_2 mass flow (stoich)	4.764 kg/h (114.3 kg/d)	CALCULATED
H_2O mass flow (stoich)	5.364 kg/h (128.7 kg/d)	CALCULATED
Mass closure (in − out)	-0.0e+00 kg/h	CHECK ~ 0
Electrolyzer energy	55 kWh/kg H_2	ASSUMPTION (unverified)
Electrolyzer input	33.01 kW	CALCULATED
Round-trip We,out / We,in	30.3 %	CALCULATED
Engine heat, LHV basis (LHV − We)	10.00 kW	CALCULATED
Condensing latent heat (HHV − LHV)	3.64 kW	CALCULATED
Total heat to cooling loop	13.64 kW	CALCULATED
Radiator flux (320 K / 210 K, ε=0.9, 2-face)	0.872 kW/m²	CALC. from ASSUMED temps
Radiator area, one module	15.6 m²	ORDER-OF-MAGNITUDE
Radiator area, ten modules	156 m²	ORDER-OF-MAGNITUDE

WHY THIS IS NOT A SOURCE OF FREE ENERGY



Electricity accounting for continuous closed water loop (one module)



HHV thermoneutral minimum to make this H_2 (CALCULATED): 23.64 kW electrical (no external heat). Real systems need more (33 kW assumed). Round trip is always below 100%.

If the water loop is closed, burning the H_2 and O_2 just puts the water back. Net work comes only from the upstream electricity (fission or solar, assumed).

Crew O_2 (~0.84 kg/person/day, NASA Baseline Values and Assumptions Document) is ~1.7 kg/day for two people, under 2% of one module's ~114 kg/day O_2. The O_2 plant is sized by the engine, not the crew.
Flows (~0.60 kg/h H_2, ~4.8 kg/h O_2, ~5.4 kg/h water, ~114 kg O_2/day) are CALCULATED from the assumed 10 kWe at 50%; mass balance closes.

TEMPERATURE, DRYING, AND HEAT REJECTION (limits, not a thermal design)

- Exhaust is Ar + water vapor. Water must be condensed and the argon dried before reuse. Incomplete drying returns steam to the intake, lowering γ toward a polyatomic mix and risking ice in a Mars-cold gallery.
- Condenser setpoint is OPEN: high enough to avoid freeze in lines (~>0 °C locally), low enough to drop most of the water. Trace heat, drain-back, and no dead legs are required in principle. No MAWP or tube count is given.
- Engine heat ~10 kW (LHV basis) PLUS ~3.6 kW condensing latent heat = ~13.6 kW per module must leave the underground room.

ASSUMED radiator (320 K panel, ~210 K sink, ε = 0.9, two-sided) gives ~0.87 kW/m² -> ~15.6 m² for one module, ~156 m² for ten. Dust, view factor, solar load not included.

- UNRESOLVED: condensing happens at a low temperature (water must not freeze); a 320 K radiator cannot take that heat without a heat pump or a larger, cooler radiator. Radiator area rises steeply as panel temperature falls.
- Coolant is a liquid loop through a service shaft to a surface radiator. Do not dump this heat into occupied habitat air. Battery warming, if used, is a separate liquid loop through a fire wall.
- Parasitic loads (Ar blower, feed compressors if used, coolant pumps, trace heat, controls) reduce net kWe below the 10 kW notional. Not sized here (UNVERIFIED).
- NOT this design: a closed Brayton loop with argon (or He–Xe) heated by a reactor, with no H_2/O_2 combustion. It has no water product. Listed only so it is not confused with APC.

PROJECT	TITLE	DWG NO.	REV	SHEET
Independent Mars concept: stationary power module H_2–O_2–Ar piston power module · underground equipment room Closed-loop Argon Power Cycle (APC) piston engine · stationary power + water, not propulsion	Mass and energy balance — one 10 kWe notional module Units: SI (m, kg/h, kW, kPa). Argon is working fluid, not fuel.	MPM-002 DATE 2026-11-19 Bryan Adams, independent concept, Tacoma WA · Not affiliated with any agency or company · Do not fabricate	B SCALE NTS	2 of 4

PRELIMINARY CONCEPT — NOT FOR FABRICATION · NOT A CERTIFIED DRAWING · NO BORE / STROKE / RPM / ALLOY / MAWP SHOWN

LONG SECTION — NOT TO SCALE · first module in a bored gallery / tunnel (size TBD)

OVERBURDEN / ROCK ABOVE (site geometry UNVERIFIED — no void assumed)

No open hydraulic path from the ice plant, wells, or tanks into this room. Water column on Mars = 3.73 kPa per metre (NASA g = 3.73 m/s²).

Service shaft (coolant + cables + purge vent) goes up to the surface radiator. Habitable volume is isolated by locks / bulkheads to the right.

ENGINE GALLERY · bored tunnel concept · tunnel size TBD

BAY 1 H_2 store	BAY 2 O_2 store	BAY 3 ENGINE	BAY 4 future / spare	LOCK / BULKHEAD
SKID T-101 separated	SKID T-102 separated	SKID E-101 + G-101 FIRST MODULE	SKID added module or spare	to gallery habitat side no shared air
raised plinth + grate	raised plinth + grate	raised plinth + grate	raised plinth + grate	

SUMP PUMP P-201 (needs independent power)

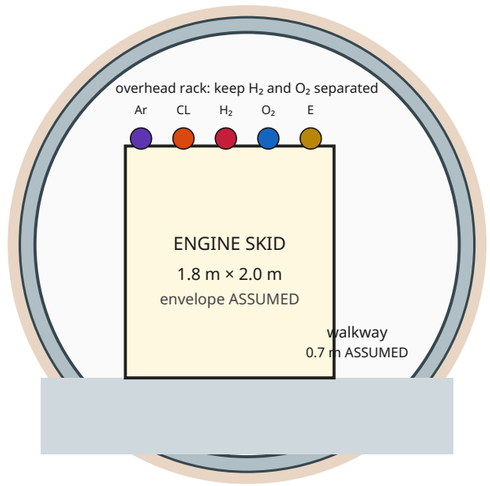
Watertight bays (SOLAS II-1 / FEMA P-936 used as Earth analogy, not Mars code). One flood or fire stays in one bay. Grated floor: water to sump; provide fine-mesh pans against dust.

SIDE BAY — BATTERIES (if used)
Own fire-rated volume and own air
Heat via liquid loop only

ELECTROLYZER (plant, not on skid)
Powered by fission/solar, not by this engine
Returns H_2/O_2 to T-101 / T-102

HABITAT SIDE (not designed here)
Occupied volume segregated from O_2, H_2, and hot machinery
Do not route fuel or raw engine exhaust through living spaces

CROSS-SECTION — ILLUSTRATIVE (tunnel size TBD)



Tunnel and liner are illustrative only; skid size and 0.7 m walkway are ASSUMED.

ARRANGEMENT RULES — SHEET 3

1. The first module is one ~10 kWe skid (ASSUMED). Number of modules and spares is not decided.
2. Skid external envelope 1.8 m W × 2.0 m H is the author's assumption, drawn to sit in a bored tunnel (size TBD) with a 0.7 m walkway. Cargo lander door fit is UNVERIFIED (door size unpublished). If the door is smaller, ship as flat-pack sub-modules and assemble in the bay.
3. Do not invent internal engine architecture. No crankcase section, no bore/stroke, no head-bolt pattern, no shaft height. Those await a selected Earth APC engine or a clean-sheet design by licensed engineers.
4. Flood: a leak from above or from water systems sees 3.73 kPa per metre of water head (g = 3.73 m/s², NASA mean). Raised plinth, watertight bulkheads, grated deck, sump, and no gravity drain from the ice plant into this room. Sump pumps need independent power.
5. H_2 rises fast and can collect under ceilings and in pockets. Treat H_2 + O_2 in a closed bay as an explosion hazard: detection, isolation, inert purge or controlled vent away from people, no uncontrolled ignition sources in H_2 zones.
6. Grated floors let water drain to a sump and give access around the skid. Fine-mesh pans are suggested against dust.
7. No open void above the room is assumed. Treat it as a bored gallery. Do not rely on a void for volume or heat rejection.

PROJECT	TITLE	DWG NO.	REV	SHEET
Independent Mars concept: stationary power module H_2–O_2–Ar piston power module · underground equipment room Closed-loop Argon Power Cycle (APC) piston engine · stationary power + water, not propulsion	Equipment-room general arrangement (first module bay) Units: SI (m, kg/h, kW, kPa). Argon is working fluid, not fuel.	MPM-003 DATE 2026-11-19 Bryan Adams, independent concept, Tacoma WA · Not affiliated with any agency or company · Do not fabricate	B SCALE NTS	3 of 4

PRELIMINARY CONCEPT — NOT FOR FABRICATION · NOT A CERTIFIED DRAWING · NO BORE / STROKE / RPM / ALLOY / MAWP SHOWN

SYSTEM BOUNDARY — what this power module is, and what it is not

ICE / WATER PLANT
ice mining and melting
separate design, not shown
no open drain into
equipment room
fission heat assumed

→

FISSION POWER (assumed)
bootstrap melt + electrolysis
then baseload / backup
NASA FSP target ~40 kWe
in <6 t (secondary source)
not designed on these sheets

→

ELECTROLYZER
splits melt / product water
H_2 and O_2 to stores
~33 kW in per 10 kWe out
type not chosen (PEM,
alkaline or SOEC)

→

H_2–Ar ENGINE MODULE
this drawing set
peaking / storage path
10 kWe notional module
water recovered to plant
Ar recycled in-loop

→

SURFACE RADIATOR
rejects engine heat
~15.6 m² / module order
~156 m² / 10 modules
dust not included
service shaft only

→

HABITAT SIDE
occupied volume
isolated from H_2/O_2
and hot machinery
own life support
not designed here

POWER ROLES (author's concept, ASSUMED)

Fission (or landed electrical/solar) power comes first: it melts ice and runs electrolysis to make the first H_2 and O_2 while an argon separator charges the loop. The engine cannot black-start that chain.

Once H_2/O_2 are stored, the APC engine is dispatchable peaking / night / dust-storm conversion of stored chemical energy, recovering the water. Fission then drops toward baseload or backup. Solar can store daytime energy as hydrogen.

This is complementary storage, not a second primary source. Round-trip electricity is about 30% in the bookkeeping case (10 kWe out / 33 kW electrolyzer in). A fuel cell or batteries could serve the same role; no head-to-head comparison has been done (OPEN).

STARTUP (CONCEPT SEQUENCE — NOT A PROCEDURE QUALIFICATION)

1. Confirm gallery dry, bulkheads closed, detectors live, radiator loop filled.
2. Independent power up (fission/solar/batteries). Do not crank on empty bus.
3. Charge Ar loop from buffer / separator; leak-check. No H_2 or O_2 yet.
4. Inert purge of engine and feed lines. Verify O_2 train isolated.
5. Bring condenser and coolant to a freeze-safe setpoint.
6. Admit Ar recycle, then metered H_2, then metered O_2 (oxidizer last).
7. Ignite only with confirmed mixture control and running coolant.
8. Sync G-101 to bus at low load; raise load after condenser is stable.
9. Route product water to T-104. Do not send it to a lower level.

SHUTDOWN / ISOLATION (CONCEPT)

1. Reduce load; stop O_2 first, then H_2; continue Ar purge/recycle.
2. Close XV-101 and XV-102 (double block). Vent or recycle residuals by a written oxygen-safe procedure (not written here).
3. Keep coolant running until E-101 is cool enough to avoid bake / seize.
4. Drain condenser water to T-104; keep lines from freezing.
5. On H_2 detector alarm: isolate feeds, inhibit ignition, vent away from habitat, do not enter the bay until cleared.
6. On flood alarm: isolate water sources above, run P-201 if powered, trip electrical gear on the affected side of the bulkhead.
7. Habitat stays behind the lock. No shared ventilation with H_2/O_2 bays.

SAFETY BOUNDARIES AND OPEN ITEMS

Oxygen compatibility: pure O2 fires start easier and spread faster. Keep bulk O2 out of living areas. Design the O2 train for oxygen service.

Control leaks and dead-ended O2 piping. Hydrogen leak management: detect, isolate, avoid unplanned ignition. H2 rises. Do not treat Ar as an oxidizer or a fuel.

Occupied habitat is not an engine room. Bulk H2, bulk O2, and hot machinery stay in segregated bays.

Batteries, if placed next to the equipment room for waste heat, get their own fire-rated volume and liquid-loop heat only.

OPEN items: tunnel size and pressurization; existing engine vs clean-sheet design; head-to-head vs batteries/fuel cells;
condenser and argon-separator mass; cargo lander door fit (UNVERIFIED); site geology; parasitic loads; condenser/radiator temperature; licensed pressure design.

Not shown and not to be inferred: bore, stroke, rod length, rpm, compression ratio, peak pressure, alloys, welds, relief sizes, or a fabrication BOM.

Analogues for orientation, not Mars qualification: Noble Thermodynamic Systems / CEC APC project; UC Berkeley and Tongji University APC papers; NASA NSSDC gravity and atmosphere;
NASA FSP targets (power plant, not this engine); NASA-STD-6001B oxygen fire discipline; SOLAS / FEMA P-936 flood-bay analogy only.

Independent concept by Bryan Adams. Not affiliated with, reviewed by, or endorsed by any space agency, company, or society named on these sheets. Estimates are labelled ASSUMED / CALCULATED / SOURCED.

PROJECT	TITLE	DWG NO.	REV	SHEET
Independent Mars concept: stationary power module H_2–O_2–Ar piston power module · underground equipment room Closed-loop Argon Power Cycle (APC) piston engine · stationary power + water, not propulsion	Plant context, startup, isolation, and safety boundaries Units: SI (m, kg/h, kW, kPa). Argon is working fluid, not fuel.	MPM-004 DATE 2026-11-19 Bryan Adams, independent concept, Tacoma WA · Not affiliated with any agency or company · Do not fabricate	B SCALE NTS	4 of 4