ENGINEERING DOCUMENTATION

Standard Hat Unit Type I

Dimensional & Integration Guide

DOCUMENT	REVISION / ISSUE	STATUS
DIG-ES-HG-S24-F20-R80	DRAFT-08 / 26 Aug 2026	Engineering Integration Reference

Integration Overview

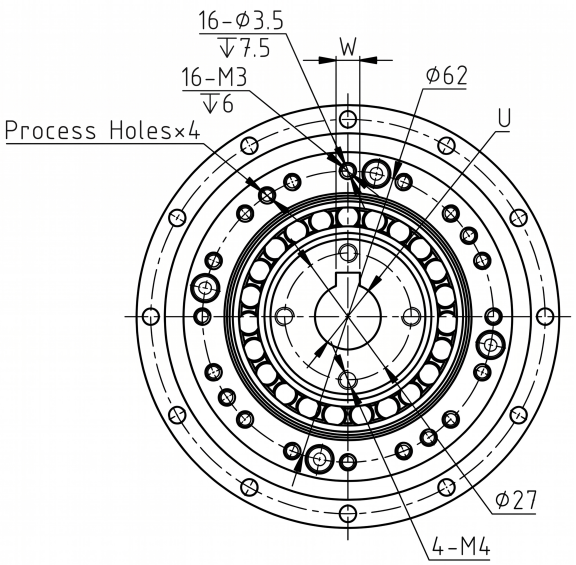
Hat-form harmonic gear gear unit with integrated product interfaces for the selected configuration for compact, coaxial, high-ratio rotary axes. This guide supports host-interface design, wave-generator input integration, mounting alignment, load-cycle validation, torsional behavior, lubrication, sealing and commissioning for ES-HG-S24-F20-R80.

Key Integration Facts

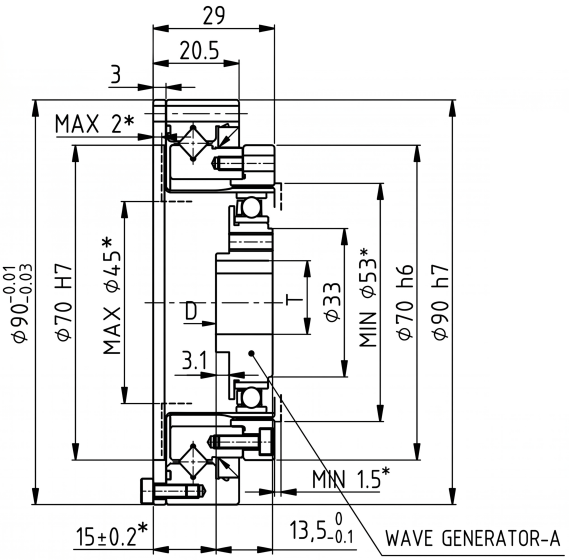
INTEGRATION ITEM	PUBLISHED VALUE
Rated Torque	34 N·m
Instantaneous Maximum Torque	127 N·m
Start/Stop Peak Torque	74 N·m
Backlash	≤20 arc sec
Reduction Ratio	80
Maximum Input Speed	6500 r/min
Frame Size	20
Weight	0.72 kg

Product Structure & Views

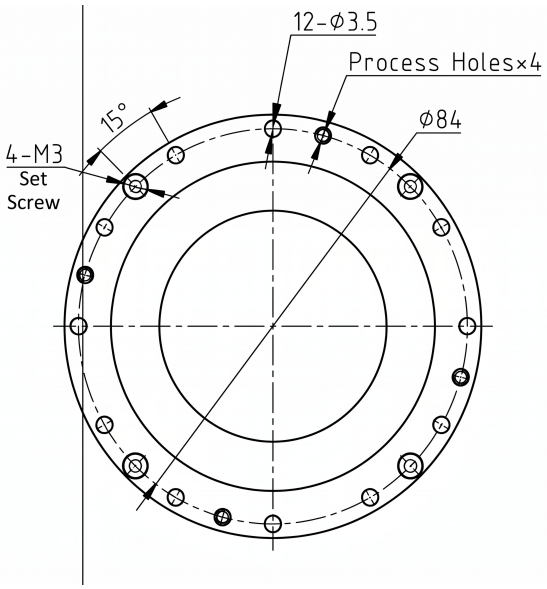
These views present the selected product structure, mounting interfaces and relevant integration geometry for this SKU.



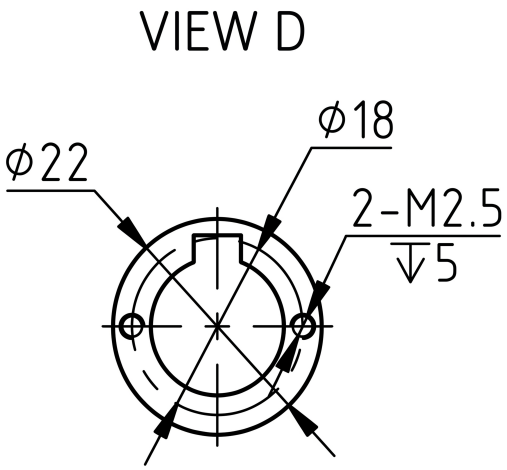
Mechanical View 1



Mechanical View 2



Mechanical View 3



Mechanical View 4

VIEW	FIELD	VALUE
Mechanical View 1	Sixteen diameter 3.5 holes	16 holes, diameter 3.5 mm
	Depth-style value for diameter 3.5 hole callout	D/depth-style value 7.5 mm associated with 16-Ø3.5
	Sixteen M3 threaded holes	16 threaded holes, M3
	Depth-style value for M3 threaded holes	D/depth-style value 6 mm associated with 16-M3
	Outer diameter	Diameter 62 mm
	Width symbol W	Width symbol W; numeric value not specified in this crop
	Interface or orientation label U	Label U; numeric value not specified
	Process holes quantity	Process holes ×4
	Diameter 27 hole or circular feature	Diameter 27 mm
	Four M4 threaded holes	4 threaded holes, M4
Mechanical View 2	Upper overall length	29 mm
	Upper step length	20.5 mm
	End small step width	3 mm
	Maximum clearance or chamfer dimension	Maximum 2 mm, starred condition
	Left outer mounting diameter with tolerance	Diameter 90 mm, upper deviation -0.01 mm, lower deviation -0.03 mm
	Left bore or mating diameter	Diameter 70 mm H7 fit
	Maximum allowed diameter	Maximum diameter 45 mm, starred condition
	Datum or section marker D	Datum/marker D
	Local end dimension	3.1 mm
	Shaft end diameter	Diameter 33 mm
	Minimum allowed diameter	Minimum diameter 53 mm, starred condition
	Right shaft fit diameter	Diameter 70 mm h6 fit
	Right outer fit diameter	Diameter 90 mm h7 fit
	Minimum clearance dimension	Minimum 1.5 mm, starred condition
	Bottom local length with tolerance	13.5 mm, upper deviation 0 mm, lower deviation -0.1 mm
	Bottom left length with tolerance	15 mm ±0.2 mm, starred condition
	Component name	Wave Generator-A
	Datum or section marker T	Datum/marker T
Mechanical View 3	Diameter of 12 holes	12 holes, diameter Ø3.5
	Number of process holes	Process holes quantity 4
	Hole pitch circle diameter	Diameter Ø84
	M3 set screw quantity	4 × M3 set screws
	Hole angular spacing	15°
Mechanical View 4	View D label	View D
	Hole diameter	Diameter 18 mm

VIEW	FIELD	VALUE
Outer diameter	Diameter 22 mm	
Threaded hole quantity and size	2 × M2.5 threaded holes	
Depth-style value for M2.5 threaded holes	D/depth-style value 5 mm associated with 2-M2.5	

Overall Dimensions and Input Interface

PARAMETER	PUBLISHED VALUE	UNIT
Frame Size	20	
Weight	0.72	kg
Wave Generator Dimension T	9.4+0.10 / 16.3+0.10 / 12.8+0.10	mm
Wave Generator Bore U	ϕ1H7 / ϕ4H7 / ϕ8H7	
Wave Generator Keyway W	3JS9/P9 / 4JS9/P9 / 5JS9/P9	

- Confirm the selected series, frame size and ratio before using dimensions or interface geometry. Do not substitute a nearby frame or product form.
- Design the input shaft, key, effective engagement and axial retention to transmit the verified torque without uncontrolled wave-generator axial movement.
- Reserve assembly, sealing, inspection and removal access around the input, housing and output interfaces.

Mounting, Alignment and Fastener Control

- Keep mounting faces flat, clean and free of burrs, raised holes, debris and coating buildup. Confirm reliefs and chamfers prevent interference.
- Seat the fixed and flexible gear members in the host structure before inserting the wave generator. Do not force engagement in a misaligned condition.
- Control concentricity, tilt and axial position of the input and housing datums. Insert the wave generator smoothly without excessive force on its bearing.
- Tighten fasteners in a staged diagonal sequence using the applicable torque and locking specification. Verify free, even rotation during assembly.

Torque, Speed and Duty Boundaries

PARAMETER	PUBLISHED VALUE	UNIT
Rated Torque	34	N·m
Allowable Average Torque	47	N·m
Start/Stop Peak Torque	74	N·m
Instantaneous Maximum Torque	127	N·m
Maximum Input Speed	6500	r/min
Average Input Speed	3500	r/min
Design Life	15000	h

- Calculate average torque and average input speed from the complete acceleration, constant-speed, deceleration, dwell and reversal cycle.
- Treat start/stop peak and instantaneous maximum torque as transient boundaries. Do not use either value as a continuous operating point.
- Validate design life against actual torque, speed, shock frequency, lubrication, temperature, alignment and external loading.

Published Torque, Speed and Life Boundaries

PARAMETER	PUBLISHED VALUE	INTEGRATION REQUIREMENT
Rated Torque	34 N·m	Use as the selected continuous output rating under validated duty and thermal conditions.
Allowable Average Torque	47 N·m	Calculate the actual time-weighted output torque over the complete cycle.
Start/Stop Peak Torque	74 N·m	Transient start/stop boundary; include acceleration and deceleration events.
Instantaneous Maximum Torque	127 N·m	Short-duration shock boundary only; do not use as a normal operating point.
Maximum Input Speed	6500 r/min	Maximum input-speed boundary; also verify motor and thermal limits.
Average Input Speed	3500 r/min	Validate the time-weighted average input speed over the complete duty cycle.
Design Life	15000 h	Design reference only; actual life depends on torque, speed, shock, lubrication and installation.

Transmission Accuracy and Torsional Rigidity

PARAMETER	PUBLISHED VALUE	UNIT
Backlash	≤20	arc sec

- Installed positioning performance depends on reducer behavior, datum control, fastener distortion, motor and encoder errors, host stiffness and thermal growth.
- Use the published stiffness regions and transition torques when evaluating compliance, resonance, control gain and direction reversal.

Published Accuracy and Torsional Rigidity Boundaries

PARAMETER	PUBLISHED VALUE	INTEGRATION REQUIREMENT
Backlash	≤20 arc sec	Validate at the selected measurement condition and installed preload state.

Lubrication, Sealing and Thermal Control

- Use only the current lubricant, fill method and quantity for the exact configuration. Do not mix incompatible lubricants.
- Provide compatible static and dynamic sealing at the input, output and housing interfaces without distorting the reducer or restricting motion.
- Validate lubricant distribution and temperature for the installed orientation, speed, load cycle and enclosure.
- Prevent chips, fibers, cleaning residue, moisture and other contamination from entering the gear or bearing cavities during assembly and service.

Output Bearing and External Load Path

- Calculate radial, axial and moment loads at the output, including offset, acceleration, gravity, process force, impact and emergency-stop cases.
- Do not infer permissible external load from reducer torque capacity or frame size. Use applicable output-bearing data and safety criteria.
- Avoid forcing, impact, misalignment or host distortion through the output support bearing during installation and operation.

Integration Checklist

01	Confirm the drawing, published parameters and applicable assembly data identify this SKU.
02	Verify series, frame size, ratio, product form and input-interface dimensions.
03	Check mounting-face flatness, concentricity, tilt, chamfers, reliefs, cleanliness and support stiffness.
04	Verify input shaft, key, engagement length and axial wave-generator retention.
05	Assemble the fixed and flexible gear members before inserting the wave generator.
06	Use staged diagonal tightening and verify free, even rotation throughout assembly.
07	Calculate average, start/stop peak and shock torque over the complete operating cycle.
08	Validate average and maximum input speed, design life and installed thermal condition.
09	Evaluate backlash, angular accuracy, hysteresis and stiffness regions for the control system.
10	Confirm exact lubricant, fill quantity, orientation, sealing and contamination controls.
11	Validate output radial, axial and moment loads using applicable bearing data.
12	Include specified 2D, STEP, assembly, lubrication and bearing-load data in integration planning.

View SKU Product Datasheet **Request controlled 2D drawing** **Request controlled STEP review** **Request a Quote**

Engineering Use and Verification Notice

01. This Dimensional & Integration Guide applies only to EmbodyStack SKU ES-HG-S24-F20-R80 and is intended for dimensional evaluation and preliminary integration. It is not a applicable manufacturing drawing, reducer selection approval, bearing-load approval, lubrication specification, machinery risk assessment, safety validation or integration planning document and must not be used as the sole basis for machining, shaft or key manufacture, fastener selection, sealing, lubricant filling or final integration. Before design freeze, assembly or commissioning, verify all dimensions, datum geometry, fits, shaft and key interfaces, wave-generator retention, fastener engagement and tightening controls, torque and speed duty, shock cases, torsional accuracy and rigidity, external output loads, lubrication, sealing, temperature, contamination and maintenance requirements against the applicable EmbodyStack engineering data for this exact SKU. Where this guide and applicable product documentation differ, the applicable product documentation governs. Validate the complete reducer, motor, host structure, output load, motion cycle, guarding, fault cases and applicable regulatory requirements under intended operating conditions.