ENGINEERING DOCUMENTATION

High-Torque Hat Unit Type I

Dimensional & Integration Guide

DOCUMENT	REVISION / ISSUE	STATUS
DIG-ES-HG-S07-F20-R120	DRAFT-08 / 26 Aug 2026	Engineering Integration Reference

Integration Overview

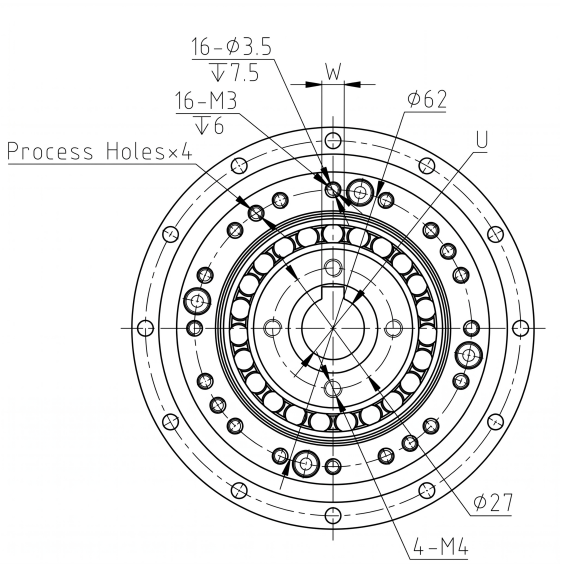
Hat-form harmonic gear gear unit with integrated product interfaces for the selected configuration for compact, coaxial, high-ratio rotary axes. This guide supports host-interface design, wave-generator input integration, mounting alignment, load-cycle validation, torsional behavior, lubrication, sealing and commissioning for ES-HG-S07-F20-R120.

Key Integration Facts

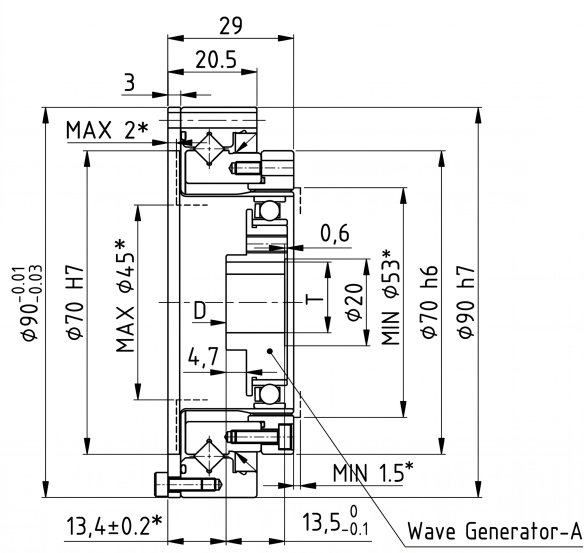
INTEGRATION ITEM	PUBLISHED VALUE
Rated Torque	52 N·m
Instantaneous Maximum Torque	191 N·m
Start/Stop Peak Torque	113 N·m
Reduction Ratio	120
Maximum Input Speed	6500 r/min
Frame Size	20
Weight	0.72 kg

Product Structure & Views

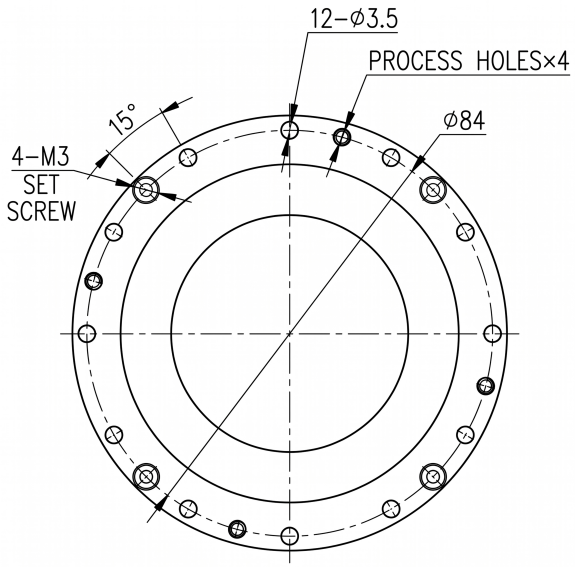
These views present the selected product structure, mounting interfaces and relevant integration geometry for this SKU.



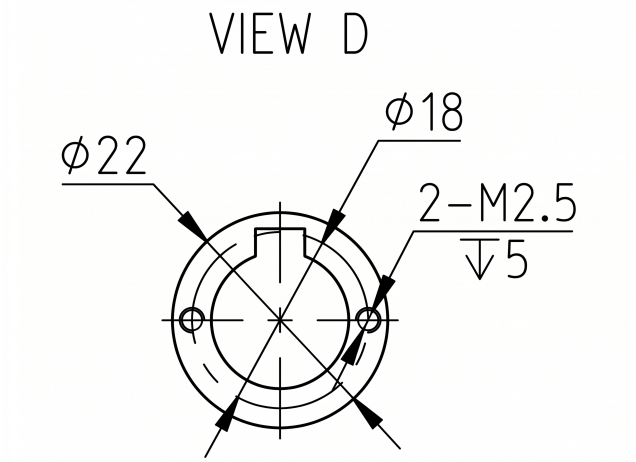
Mechanical View 1



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 for diameter 3.5 holes	Depth 7.5 mm
	Width W	Width W, value not specified in this crop
	Diameter 62	Diameter 62 mm
	Sixteen M3 threaded holes	16 M3 threaded holes
	Depth for M3 threaded holes	Depth 6 mm
	Variable U	U, value not specified in this crop
	Process holes quantity four	Process holes ×4
	Diameter 27	Diameter 27 mm
	M4 threaded holes	M4 threaded holes; quantity not reliably OCR-confirmed
Mechanical View 2	Overall Length	29 mm
	Internal Section Length	20.5 mm
	Mounting Boss Depth	3 mm
	Maximum Radial Deviation	MAX 2 mm (reference)
	Clearance or Feature Height	0.6 mm
	Maximum Outer Diameter	MAX Φ45 mm (reference)
	Minimum Inner Diameter	MIN Φ53 mm (reference)
	Mounting Flange Outer Diameter	Φ90 -0.01/-0.03 mm
	Mounting Bore Diameter	Φ70 H7
	Shaft Diameter	Φ20 mm
	Wave Generator Shaft Diameter	Φ30 h7
	Feature Dimension or Clearance	4.7 mm
	Minimum Clearance	MIN 1.5 mm (reference)
	Mounting Height	13.5 0/-0.1 mm
	Mounting Reference Height	13.4±0.2 mm (reference)
	Datum Reference	Datum D
Mechanical View 3	12 holes diameter 3.5	12 holes, diameter 3.5 mm
	Process holes quantity	Process holes, quantity 4
	Diameter 84 circle	Diameter 84 mm
	4 M3 set screws	4 × M3 set screw
Mechanical View 4	Detail view identifier	View D
	Inner hole diameter	Diameter 18 mm
	Outer circular feature diameter	Diameter 22 mm
	Threaded hole quantity and size	2 holes, M2.5 thread
	Depth callout	Depth 5 mm

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	ϕ8H7 / ϕ14H7 / ϕ11H7	
Wave Generator Keyway W	4JS9/P9 / 3JS9/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	52	N·m
Allowable Average Torque	64	N·m
Start/Stop Peak Torque	113	N·m
Instantaneous Maximum Torque	191	N·m
Starting Torque	4.2	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	52 N·m	Use as the selected continuous output rating under validated duty and thermal conditions.
Allowable Average Torque	64 N·m	Calculate the actual time-weighted output torque over the complete cycle.
Start/Stop Peak Torque	113 N·m	Transient start/stop boundary; include acceleration and deceleration events.
Instantaneous Maximum Torque	191 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
Angle Transmission Accuracy	1	arcmin
Hysteresis Loss	1	arcmin
Torsional Rigidity K1	1.6	×10⁴N·m/rad
Torsional Rigidity K2	2.5	×10⁴N·m/rad
Torsional Rigidity K3	2.9	×10⁴N·m/rad
Torsional Rigidity T1	7	N·m
Torsional Rigidity T2	25	N·m

- 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
Angle Transmission Accuracy	1 arcmin	Installed system accuracy also depends on datum, encoder, motor and structural errors.
Hysteresis Loss	1 arcmin	Include in direction-reversal and closed-loop positioning evaluation.
Torsional Rigidity K1	1.6 ×10⁴N·m/rad	Applies to the published low-torque stiffness region.
Torsional Rigidity K2	2.5 ×10⁴N·m/rad	Applies to the published intermediate stiffness region.
Torsional Rigidity K3	2.9 ×10⁴N·m/rad	Applies to the published upper stiffness region.
Torsional Rigidity T1	7 N·m	Published transition torque for stiffness-region interpretation.
Torsional Rigidity T2	25 N·m	Published transition torque for stiffness-region interpretation.

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-S07-F20-R120 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.