ENGINEERING DOCUMENTATION

High-Torque Hat Component Set

Dimensional & Integration Guide

DOCUMENT	REVISION / ISSUE	STATUS
DIG-ES-HG-S04-F25-R120	DRAFT-08 / 26 Aug 2026	Engineering Integration Reference

Integration Overview

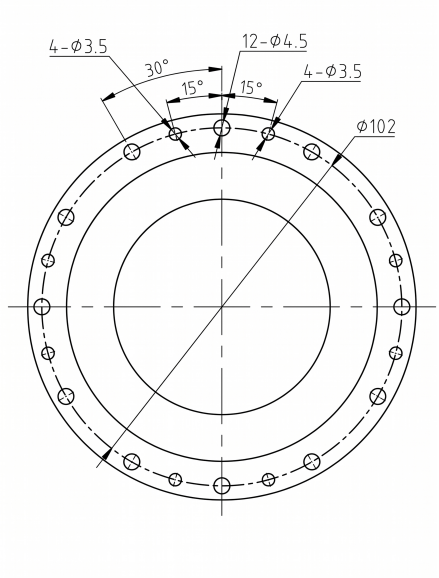
Hat-form harmonic gear component set requiring specified host housing, support-bearing and sealing integration for compact, coaxial, high-ratio rotary axes. This guide supports host-interface design, wave-generator input integration, mounting alignment, load-cycle validation, torsional behavior, lubrication, sealing and commissioning for ES-HG-S04-F25-R120.

Key Integration Facts

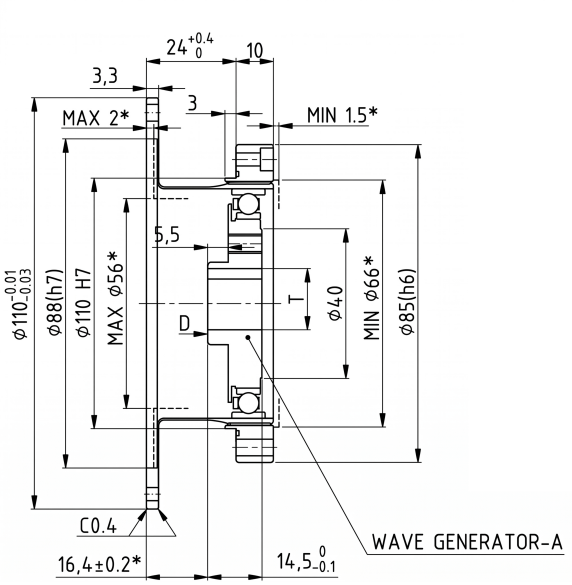
INTEGRATION ITEM	PUBLISHED VALUE
Rated Torque	87 N·m
Instantaneous Maximum Torque	395 N·m
Start/Stop Peak Torque	217 N·m
Backlash	≤20 arc sec
Reduction Ratio	120
Maximum Input Speed	5600 r/min
Frame Size	25
Weight	0.46 kg

Product Structure & Views

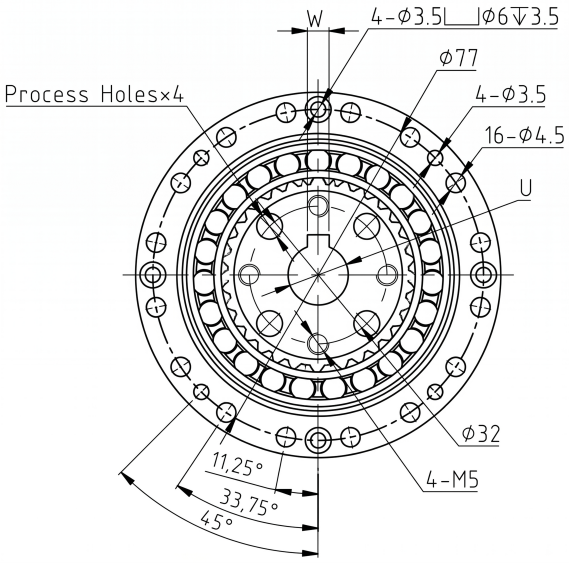
These views present the selected product structure, mounting interfaces and relevant integration geometry for this SKU.



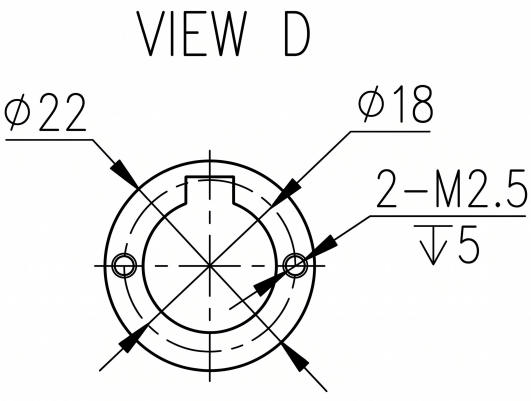
Mechanical View 1



Mechanical View 2



Mechanical View 3



Mechanical View 4

VIEW	FIELD	VALUE
Mechanical View 1	Diameter of 12 holes	12 holes, diameter 4.5
	Diameter of left 4 holes	4 holes, diameter 3.5
	Diameter of right 4 holes	4 holes, diameter 3.5
	Hole angular spacing	30 degree angular spacing
	Left hole angular offset	15 degree angular offset
	Right hole angular offset	15 degree angular offset
	Bolt circle diameter	Bolt circle diameter 102
Mechanical View 2	Upper axial distance	24 +0.4/0
	Adjacent upper axial distance	10
	Upper left local spacing	3.3
	Upper local thickness	3
	Minimum clearance	Minimum 1.5
	Maximum clearance	Maximum 2
	Middle local spacing	5.5
	Maximum outside diameter	Maximum diameter 56
	Minimum clearance diameter	Minimum diameter 66
	Shaft fit diameter	Diameter 85 h6
	Bore fit diameter	Diameter 110 H7
	Shaft fit diameter	Diameter 88 h7
	Shaft diameter	Diameter 40
	Diameter tolerance	Diameter 110 -0.01/-0.03
	Datum D	Datum D
	Chamfer	Chamfer C0.4
	Component name	Wave generator-A
	Bottom axial distance	14.5 0/-0.1
	Left axial positioning dimension	16.4±0.2*
	Datum T	Datum T
Mechanical View 3	W labeled width	W dimension value Not specified
	4-hole counterbore/depth callout	4 holes Ø3.5 with Ø6 counterbore or spotface, depth 3.5
	Hole pitch circle diameter	Ø77
	Process holes quantity	Process holes quantity: 4
	4 holes diameter	4 holes Ø3.5
	16 holes diameter	16 holes Ø4.5
	U labeled feature	U value Not specified
	Hole pitch circle diameter	Ø32
	Angular spacing 11.25 degrees	11.25°

VIEW	FIELD	VALUE
4 M5 threaded holes	4 M5 threaded holes	
Angular spacing 33.75 degrees	33.75°	
Angular spacing 45 degrees	45°	
Mechanical View 4	View designation	View D
	Diameter 22 circular feature	Diameter 22 mm
	Diameter 18 circular feature	Diameter 18 mm
	Two M2.5 threaded holes with depth	2 × M2.5 threaded holes, depth 5 mm

Overall Dimensions and Input Interface

PARAMETER	PUBLISHED VALUE	UNIT
Frame Size	25	
Weight	0.46	kg
Wave Generator Dimension T	12.8+0.10 / 16.3+0.10	mm
Wave Generator Bore U	ϕ11H7 / ϕ14H7	
Wave Generator Keyway W	5JS9/P9 / 4JS9/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	87	N·m
Allowable Average Torque	140	N·m
Start/Stop Peak Torque	217	N·m
Instantaneous Maximum Torque	395	N·m
Maximum Input Speed	5600	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	87 N·m	Use as the selected continuous output rating under validated duty and thermal conditions.
Allowable Average Torque	140 N·m	Calculate the actual time-weighted output torque over the complete cycle.
Start/Stop Peak Torque	217 N·m	Transient start/stop boundary; include acceleration and deceleration events.
Instantaneous Maximum Torque	395 N·m	Short-duration shock boundary only; do not use as a normal operating point.
Maximum Input Speed	5600 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-S04-F25-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.