ENGINEERING DOCUMENTATION

High-Torque Hat Unit Type I

Dimensional & Integration Guide

DOCUMENT	REVISION / ISSUE	STATUS
DIG-ES-HG-S07-F45-R160	DRAFT-08 / 26 Aug 2026	Engineering Integration Reference

Integration Overview

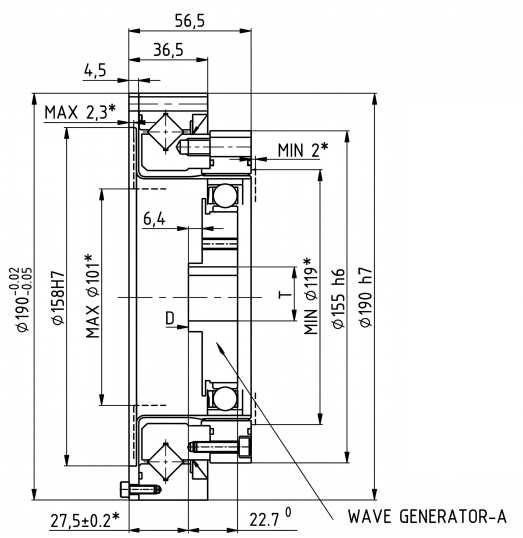
Hat-form harmonic gear gear unit with integrated product interfaces for the selected configuration for compact, coaxial, high-ratio rotary axes. This guide supports host-interface design, wave-generator input integration, mounting alignment, load-cycle validation, torsional behavior, lubrication, sealing and commissioning for ES-HG-S07-F45-R160.

Key Integration Facts

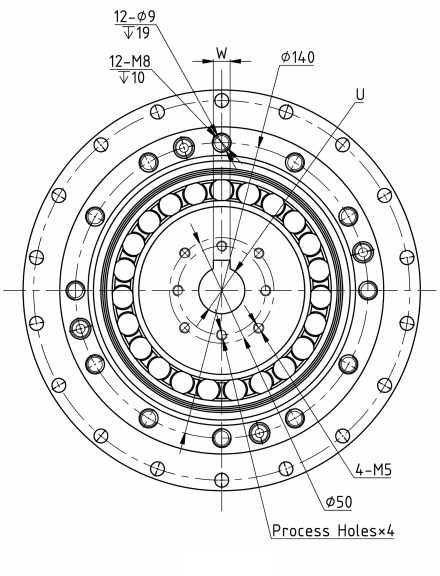
INTEGRATION ITEM	PUBLISHED VALUE
Reduction Ratio	160
Frame Size	45

Product Structure & Views

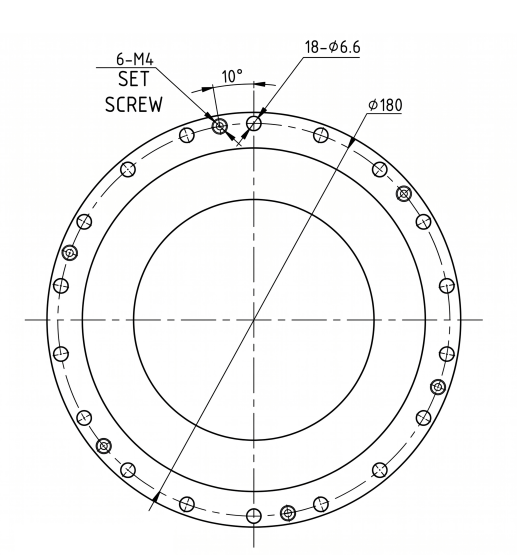
These views present the selected product structure, mounting interfaces and relevant integration geometry for this SKU.



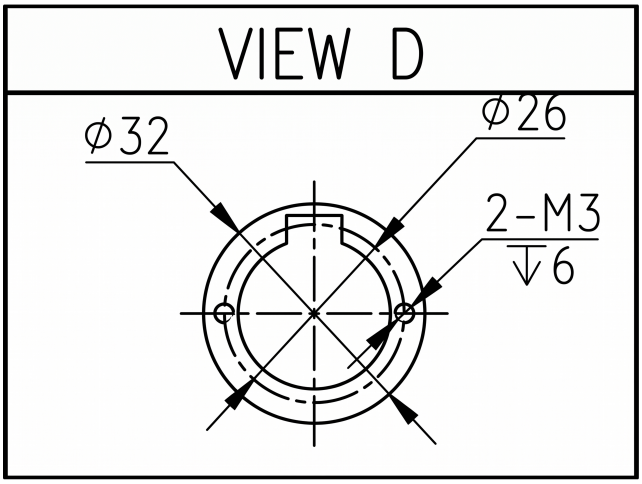
Mechanical View 1



Mechanical View 2



Mechanical View 3



Mechanical View 4

VIEW	FIELD	VALUE
Mechanical View 1	Top overall width	56.5
	Top inner width	36.5
	Upper left step offset	4.5
	Maximum clearance or protrusion	MAX 2.3
	Minimum clearance or protrusion	MIN 2
	Local transverse distance	6.4
	Left diameter with deviations	Diameter 190, upper deviation -0.02, lower deviation -0.05
	Fit diameter	Diameter 158 H7
	Maximum diameter	MAX diameter 101
	Minimum diameter	MIN diameter 119
	Fit diameter	Diameter 155 h6
	Fit diameter	Diameter 190 h7
	Datum or local identifier D	D
	Datum or local identifier T	T
	Bottom mounting offset	27.5 ±0.2
	Bottom local distance with upper deviation	22.7, upper deviation 0, lower deviation Not specified
	Component label	Wave Generator-A
Mechanical View 2	12 through holes diameter and counterbore depth	12 holes, diameter 9, depth 19
	12 M8 threaded holes and depth	12 M8 threaded holes, depth 10
	Width designation W	W, value not specified in this crop
	Diameter 140	Diameter 140
	Position designation U	U, value not specified in this crop
	M5 Tapped Holes	4-M5
	Hole Pitch Circle Diameter	Ø50
	Process Holes	Process Holes ×4
Mechanical View 3	Through hole quantity and diameter	18 holes, diameter 6.6 mm
	Set screw quantity and thread size	6 M4 set screws
	Angular spacing	10 degrees
	Bolt circle diameter	Pitch circle diameter 180 mm
Mechanical View 4	View designation	View D
	Outer diameter	Diameter 32 mm
	Hole pitch circle diameter	Diameter 26 mm
	Threaded hole specification	2 × M3 threaded holes
	Depth-style value for M3 threaded holes	D/depth-style value 6 mm associated with 2-M3

Overall Dimensions and Input Interface

PARAMETER	PUBLISHED VALUE	UNIT
Frame Size	45	
Wave Generator Dimension T	25.3+0.10 / 24.8+0.10 / 21.8+0.10	mm
Wave Generator Bore U	ϕ22H7 / ϕ9H7	
Wave Generator Keyway W	8JS9/P9 / 6JS9/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

- 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.

Transmission Accuracy and Torsional Rigidity

PARAMETER	PUBLISHED VALUE	UNIT
Angle Transmission Accuracy	1	arcmin
Hysteresis Loss	1	arcmin
Torsional Rigidity K1	18	×10⁴N·m/rad
Torsional Rigidity K2	29	×10⁴N·m/rad
Torsional Rigidity K3	33	×10⁴N·m/rad
Torsional Rigidity T1	76	N·m
Torsional Rigidity T2	275	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	18 ×10⁴N·m/rad	Applies to the published low-torque stiffness region.
Torsional Rigidity K2	29 ×10⁴N·m/rad	Applies to the published intermediate stiffness region.
Torsional Rigidity K3	33 ×10⁴N·m/rad	Applies to the published upper stiffness region.
Torsional Rigidity T1	76 N·m	Published transition torque for stiffness-region interpretation.
Torsional Rigidity T2	275 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-F45-R160 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.