Topic:

Cooperation between machine builder, tool holder manufacturer, and end-user assures process quality.

Introduction:

Some of the design objectives in the development of the HSK tool and spindle interface were improved machining accuracy, better repeatability, and reduced machining tolerances to allow production of more accurate parts.

With the HSK design, these objectives are achieved by:

- The unique design of the tool and spindle interface.
- A well-developed design with tool contact on the taper and on the face provides a stiffer and more rigid connection between tool and spindle.
- Gripping the tool on the inside of the taper increases clamping force at high speeds.
- Established proper tolerances. Tolerances for the HSK are defined in DIN 69063 for the spindle taper and in DIN 69893 for the tool holder taper.

The HSK taper as a system:

In order to benefit from the advantages of the HSK system in the manufacturing environment, an **understanding between the machine tool manufacturer, the tool holder manufacturer, and the end user** is required to ensure that certain criteria are met. In addition, it is of interest to investigate new and improved tool holder designs to achieve the maximum benefits from the system.

The machine builder must ensure:

- Spindle rigidity and spindle accuracy
- Dimensional accuracy of spindle taper, spindle face, drive keys per DIN 69063
- Proper tool clamping force to meet the desired machining parameters, and reliability of the power drawbar mechanism
- Established procedures to ensure long service life [maintenance schedule, lubrication schedule, preventive maintenance schedules]
- Cleanliness of the system
- Customer training to convey the unique and important requirements of the HSK system in order to obtain the desired benefits

The tool manufacturer must ensure:

- Compliance of taper tolerances to DIN 69893
- Process control during manufacturing
- Use of improved cutting tool clamping systems with reduced run-out such as hydraulic and heat shrink tool holders or adaptions of these (see our “cold shrink” tool holders)

Offer balanced tool holders or balanceable tool holders together with easy-to-use balancing systems

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The end user must understand:

- Using machines and tooling with HSK is not “business as usual”
- Manufacturing the HSK tooling is difficult and new for some tool manufacturers. Selection of a tool holder manufacturer who has a proven record and is known for quality can eliminate the problem of nonconforming tools. Nonconforming tools might not be clamped properly by the drawbar, or the drawbar position indication might give false signals, or lead to early spindle wear.
- Maintenance procedures given by the machine builder must be followed.
- Training the operator is very important.
- Maintaining cleanliness of tooling and spindle taper is a major requirement. Machine accuracy will suffer, and tool life will be shortened in a contaminated environment.
- Ensure proper coolant filtration as specified by the manufacturer of the machine.
- Nicks and dings on the tool taper cannot be tolerated. Proper tool holder handling and storage is essential.
- The coolant connection between drawbar and tool holder [coolant tube] should be flexible to avoid damage or early wear to the gripper seal.
- Regrinding of a worn spindle taper might be difficult or impossible.

Measuring gages ensure consistent compliance:

To ensure proper operation and close tolerance machining, inspection procedures must be in place. We also recommend checking tooling and the spindle nose periodically for wear and conformity. For preventive maintenance, we recommend periodic verification of the power drawbar clamping force. Gauges for measuring the tool holder taper and machine clamping must be available to the maintenance department. Ideally, all gages should be from the same manufacturer for consistency.

Products available from TAC Rockford:

HSK gauges for the machine spindle:

Pull force Measuring Gauge – Drawbar Pull force
A drawbar pull force gage is required to ensure proper tool clamping force is present.

Test Arbor – Spindle Run-out

Taper Plug Gauge – Measurement of Machine Spindle Accuracy

Taper Plug Air Gauge – Measurement of Machine Spindle Accuracy
The air gage column, suitable for any size HSK nozzle holder plus the nozzle holder with two setting rings is needed. These gauges are designed for spindle taper manufacturing. Measurement of the spindle is most likely possible only without the tool clamping gripper installed.

HSK A Style Tooling Key Gauge
The gage verifies the location and dimensional accuracy of drive key slots in the spindle for HSK A tooling.

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HSK gages for tool holders:

Clamping Chamfer Gauge – 30 Degree Angle

Measuring Gage – Tool Gauge Diameter d 2 and d 3

Measuring Gauge – Drive Key for HSK A/C-Style Tooling
A new type of gage to measure the accuracy, size, and radius of the drive key slot in HSK tooling [applies to HSK style A only]. Consists of “go” and a “no-go” gages.

Tool Holders:

Various tool holders are available from TAC Rockford, including tool holders for heat shrink, balanced tool holders [balanced to G 2.5 at 25,000 RPM], hydraulic chuck tool holders, inch diameter tool holders, and tool holders for the mold and die making industry. Special designs are always possible, even on short notice.

Accessories:

Coolant Tubes
Coolant tubes connect tooling with the coolant delivery system of the power drawbar. Coolant tubes are a “problem area” in the system. The flexible tubes available from TAC Rockford solve most of the typical problems.

Manual Taper Cleaning Devices – Machine Spindle
A simple and inexpensive leather covered device with air connection. When inserted into the spindle, this tool will wipe and blow the tool contact area clean. Other taper cleaners made of plastic are also available.

Taper Cleaning Devices – Tool Taper
This electrically operated tool taper cleaner is an ideal tool for the tool crib, tool setting department, or for use directly at the machine by the operator. Three rotating brushes with various stiffness rid the tool taper of dirt, grime, grease, and chips.

Mounting Fixtures
These mounting fixtures hold the tool safely in place while mounting inserts. The device can be used for horizontal and vertical mounting of tools.

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Tool Storage System
A quality tool storage system is an important investment in maintaining tools.

Heat Shrink System for Tool Holders
The heat shrink machine and tool holders for this system are available. This type of tooling system comes as close to a “one-piece” tool holder as is possible. Good balancing capabilities, rigidity, and good tool concentricity are the main features of this tool clamping system. This is an alternative to the hydraulic tool holder system with added advantages.

Tool Balancing System
A tool balancing system is critical to maintaining spindle life.

Support Material:
Additional HSK information is available on our web site – www.TACRockford.com.

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