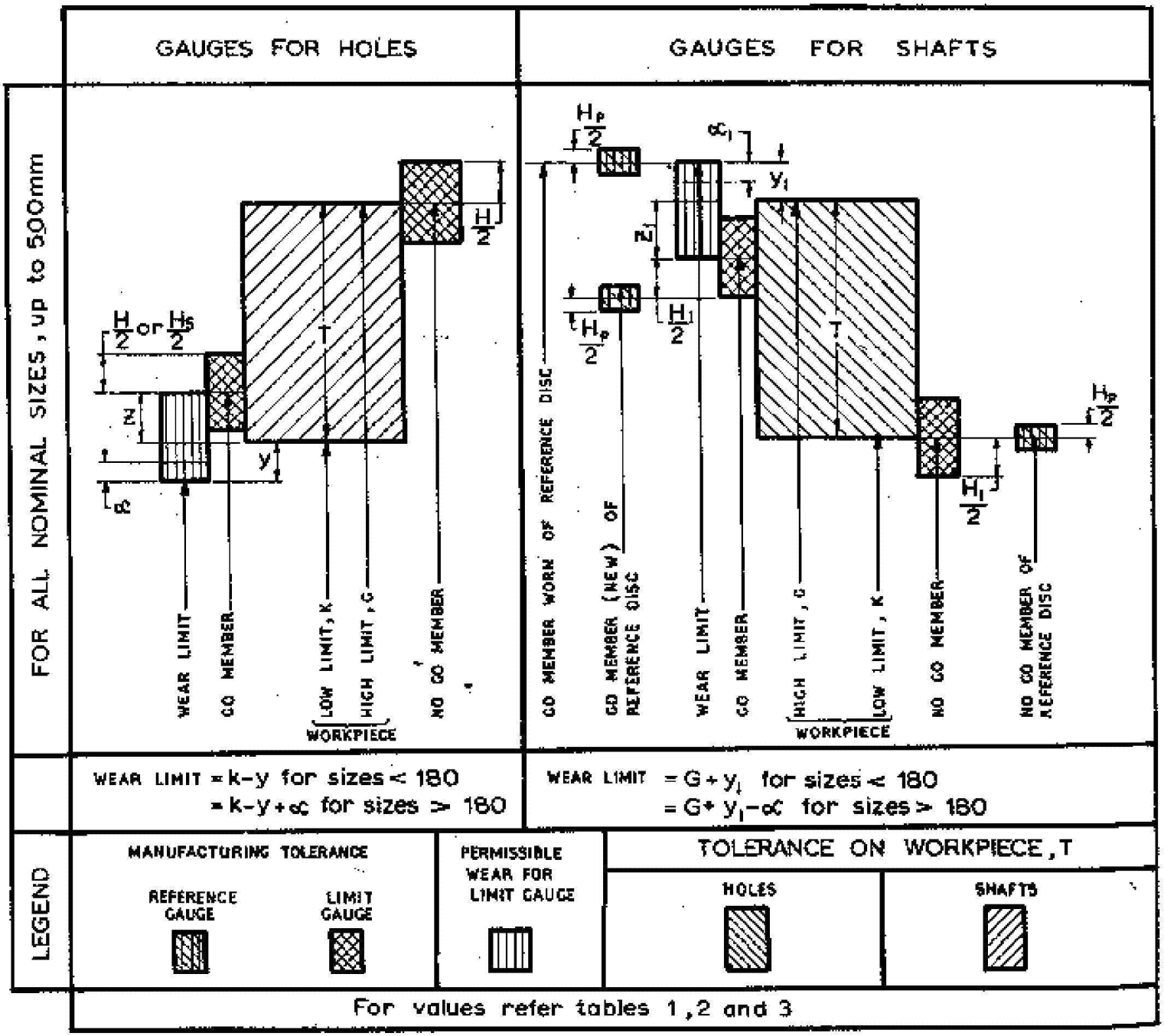
LIMIT GAUGES - 14



FORMULAE FOR GAUGE DIMENSIONS

Table 1.

GAUGES for	GAUGE size	Nominal size upto 180 mm: gauges basic size	gauges mfg tol	reference gauge basic size	reference gauge mfg tol	Nominal size over 180 mm: gauge basic size	gauge mfg tol	reference gauge basic size	reference gauge mfg tol
Inside measurements	NO GO	G	$\pm\frac{H}{2}$ or $\pm\frac{H_S}{2}$			$G-\alpha$	$\pm\frac{H_S}{2}$ or $\pm{}^{*}\frac{H}{2}$		
	GO(new)	K+Z	$\pm\frac{H}{2}$	—		K + Z	$\pm\frac{H}{2}$ or $\pm\frac{H_S}{2}$	—	
	wear limit	K − y	—			K−y+ α	—		
Outside measurements	Wear limit	G + y_1	—	G + y_1	$\pm\frac{H_P}{2}$	G + y_1− α_1	—	G+y_1− α	$\pm\frac{H_P}{2}$
	GO (new)	G − Z_1	$\pm\frac{H_1}{2}$	G − Z_1	$+\frac{H_P}{2}$	G − Z_1	$\pm\frac{H_1}{2}$	G − Z_1	$\pm\frac{H_P}{2}$
	NO GO	K	$\pm\frac{H_1}{2}$	K	$\pm\frac{H_P}{2}$	K + α_1	$\pm\frac{H_1}{2}$	K + α_1	$\pm\frac{H_P}{2}$

*For gauges other than spherical.

Nomenclature

- G, high limit of workpiece.
- H, tolerance on cylindrical, plug or cyl. bar gauges,
- H_S, tolerance on spherical gauges,
- Z_1, distance between centre of tolerance zone of new GO guages for holes and GO workpiece limit.
- K, low limit of workpiece
- y_1, margin, outside of the GO workpiece limit, of the wear limit of gauges of holes
- α_1, safety zone provided for compensating measuring uncertainties of gauges
- y_2, margin, as of y for shafts instead of holes.
- Z_2, as of Z above, for shafts instead of holes
- H_1, tolerance on gauges for shafts
- H_P, tolerance on reference discs for gap gauges
- α_2, as of α_1 above, for shafts instead of holes.
- T, workpiece tolerance = G − K

for T, H, H_S, y, Z, α refer table 2
T, H_1, H_P, y_1, Z_1, α_1 „ „ 3

GAUGE TOLERANCES FOR CHECKING HOLES

All dimensions in microns

Table 2

Nominal size, mm		Symbol	WORK TOLERANCE GRADES						
Over	upto & includ		6	7	8	9	10	11	12
–	3	T	6	10	14	25	40	60	100
		H/2	0.6	1	1	1	1	2	2
		y	1	1.5	3	0	0	0	0
		Z	1	1.5	2	5	5	10	10
3	6	T	9	12	18	30	48	75	120
		H/2	0.75	1.25	1.25	1.25	1.25	2.5	2.5
		y	1	1.5	3	0	0	0	0
		Z	1.5	2	3	6	6	12	12
6	10	T	9	15	22	36	58	90	150
		H/2	0.75	1.25	1.25	1.25	1.25	3	3
		$H_a/2$	0.75	0.75	0.75	0.75	0.75	2	2
		y	1	1.5	3	0	0	0	0
		Z	1.5	2	3	7	7	14	14
10	18	T	11	18	27	43	70	110	180
		H/2	1	1.5	1.5	1.5	1.5	4	4
		$H_a/2$	1	1	1	1	1	2.5	2.5
		y	1.5	2	4	0	0	0	0
		Z	2	2.5	4	8	8	16	16
18	30	T	13	21	33	52	84	130	210
		H/2	1.25	2	2	2	2	4.5	4.5
		$H_a/2$	1.25	1.25	1.25	1.25	1.25	3	3
		y	1.5	3	4	0	0	0	0
		Z	2	3	5	9	9	19	19
30	50	T	16	25	39	62	100	160	250
		H/2	1.25	2	2	2	2	5.5	5.5
		$H_a/2$	1.25	1.25	1.25	1.25	1.25	3.5	3.5
		y	2	3	5	0	0	0	0
		Z	2.5	3.5	6	11	11	22	22
50	80	T	19	30	46	74	120	190	300
		H/2	1.5	2.5	2.5	2.5	2.5	6.5	6.5
		$H_a/2$	1.5	1.5	1.5	1.5	1.5	4	4
		y	2	3	5	0	0	0	0
		Z	2.5	4	7	13	13	25	25
80	120	T	22	35	54	87	140	220	350
		H/2	2	3	3	3	3	7.5	7.5
		$H_a/2$	2	2	2	2	2	5	5
		y	3	4	6	0	0	0	0
		Z	3	5	8	15	15	28	28
120	180	T	25	40	63	100	160	250	400
		H/2	2.5	4	4	4	4	9	9
		$H_a/2$	2.5	2.5	2.5	2.5	2.5	6	6
		y	3	4	6	0	0	0	0
		Z	4	6	9	18	18	32	32

GAUGE TOLERANCES FOR CHECKING HOLES

Table 2 (Contd)

All dimensions in microns.

Nominal Size, mm		Symbol	WORK TOLERANCE GRADES						
Over	upto & includ.		6	7	8	9	10	11	12
180	250	T	29	46	72	115	185	290	460
		H/2	3.5	5	5	5	5	10	10
		$H_a/2$	3.5	3.5	3.5	3.5	3.5	7	7
		y	4	6	7	0	0	0	0
		Z	5	7	12	21	24	40	45
		α	2	3	4	4	7	10	15
250	315	T	32	52	81	130	210	320	520
		H/2	4	6	6	6	6	11.5	11.5
		$H_a/2$	4	4	4	4	4	8	8
		y	5	7	9	0	0	0	0
		Z	6	8	14	24	27	45	50
		α	3	4	6	6	9	15	20
315	400	T	36	57	89	140	230	360	570
		H/2	4.5	6.5	6.5	6.5	6.5	12.5	12.5
		$H_a/2$	4.5	4.5	4.5	4.5	4.5	9	9
		y	6	8	9	0	0	0	0
		Z	7	10	16	28	32	50	65
		α	4	6	7	7	11	15	30
400	500	T	40	63	97	155	250	400	630
		H/2	5	7.5	7.5	7.5	7.5	13.5	13.5
		$H_a/2$	5	5	5	5	5	10	10
		y	7	9	11	0	0	0	0
		Z	8	11	18	32	37	55	70
		α	5	7	9	9	14	20	35

GAUGE TOLERANCES FOR CHECKING SHAFTS

All dimensions in microns : Table 3

Nominal Size, mm		Symbol	WORK TOLERANCE GRADES							
Over	upto & includ.		5	6	7	8	9	10	11	12
—	3	T	4	6	10	14	25	40	60	100
		$H_1/2$	0.6	1	1	1.5	1.5	1.5	2	2
		$H_p/2$	0.4	0.4	0.4	0.6	0.6	0.6	0.6	0.6
		y_1	1	1.5	1.5	3	0	0	0	0
		Z_1	1	1.5	1.5	2	5	5	10	10
3	6	T	5	8	12	18	30	48	75	120
		$H_1/2$	0.75	1.25	1.25	2	2	2	2.5	2.5
		$H_p/2$	0.5	0.5	0.5	0.75	0.75	0.75	0.75	0.75
		y_1	1	1.5	1.5	3	0	0	0	0
		Z_1	1	2	2	3	6	6	12	12
6	10	T	6	9	15	22	36	58	90	150
		$H_1/2$	0.75	1.25	1.25	2	2	2	3	3
		$H_p/2$	0.5	0.5	0.5	0.75	0.75	0.75	0.75	0.75
		y_1	1	1.5	1.5	3	0	0	0	0
		Z_1	1	2	2	3	7	7	14	14
10	18	T	8	11	18	27	43	70	110	180
		$H_1/2$	1	1.5	1.5	2.5	2.5	2.5	4	4
		$H_p/2$	0.6	0.6	0.6	1	1	1	1	1
		y_1	1.5	2	2	4	0	0	0	0
		Z_1	1.5	2.5	2.5	4	8	8	16	16
18	30	T	9	13	21	33	52	84	130	210
		$H_1/2$	1.25	2	2	3	3	3	4.5	4.5
		$H_p/2$	0.75	0.75	0.75	1.25	1.25	1.25	1.25	1.25
		y_1	2	3	3	4	0	0	0	0
		Z_1	1.5	3	3	5	9	9	19	19
30	50	T	11	16	25	39	62	100	160	250
		$H_1/2$	1.25	2	2	3.5	3.5	3.5	5.5	5.5
		$H_p/2$	0.75	0.75	0.75	1.25	1.25	1.25	1.25	1.25
		y_1	2	3	3	5	0	0	0	0
		Z_1	2	3.5	3.5	6	11	11	22	22
50	80	T	13	19	30	46	74	120	190	300
		$H_1/2$	1.5	2.5	2.5	4	4	4	6.5	6.5
		$H_p/2$	1	1	1	1.5	1.5	1.5	1.5	1.5
		y_1	2	3	3	5	0	0	0	0
		Z_1	2	4	4	7	13	13	25	25
80	120	T	15	22	35	54	87	140	220	350
		$H_1/2$	2	3	3	5	5	5	7.5	7.5
		$H_p/2$	1.25	1.25	1.25	2	2	2	2	2
		y_1	3	4	4	6	0	0	0	0
		Z_1	2.5	5	5	8	15	15	28	28

GAUGE TOLERANCES FOR CHECKING SHAFTS

All dimensions in microns

Table 3 (Contd.)

Nominal Size, mm		Symbol	WORK TOLERANCE GRADES							
Over	upto & includ		5	6	7	8	9	10	11	12
		T	18	25	40	63	100	160	250	400
		$H_1/2$	2.5	4	4	6	6	6	9	9
120	180	$H_2/2$	1.75	1.75	1.75	2.5	2.5	2.5	2.5	2.5
		y_1	3	4	4	6	0	0	0	0
		Z_1	3	6	6	9	18	18	32	32
		T	20	29	46	72	115	185	290	460
		$H_1/2$	3.5	5	5	7	7	7	10	10
180	250	$H_2/2$	2.25	2.25	2.25	3.5	3.5	3.5	3.5	3.5
		y_1	3	5	6	7	0	0	0	0
		Z_1	4	7	7	12	21	24	40	45
		α_1	1	2	3	4	4	7	10	15
		T	23	32	52	81	130	210	320	520
		$H_1/2$	4	6	6	8	8	8	11.5	11.5
250	315	$H_2/2$	3	3	3	4	4	4	4	4
		y_1	3	6	7	9	0	0	0	0
		Z_1	5	8	8	14	24	27	45	50
		α_1	1.5	3	4	6	6	9	15	20
		T	25	36	57	89	140	230	360	570
		$H_1/2$	4.5	6.5	6.5	9	9	9	12.5	12.5
315	400	$H_2/2$	3.5	3.5	3.5	4.5	4.5	4.5	4.5	4.5
		y_1	4	6	8	9	0	0	0	0
		Z_1	6	10	10	16	28	32	50	65
		α_1	2.5	4	6	7	7	11	15	30
		T	27	40	63	97	155	250	400	630
		$H_1/2$	5	7.5	7.5	10	10	10	13.5	13.5
400	500	$H_2/2$	4	4	4	5	5	5	5	5
		y_1	4	7	9	11	0	0	0	0
		Z_1	7	11	11	18	32	37	55	70
		α_1	3	5	7	9	9	14	20	35

RECOMMENDED TYPES OF GAUGES

WORKPIECE	GAUGES	Diameter in mm					
		Over	—	6	10	120	315
		upto	6	10	120	315	—
RIGID PARTS (HOLES)	GO	CYL. PLUG				SEG. CYL.	ROD
	NO GO	CYL. PLUG		SEG. CYL. SEG. SPHER			ROD
NON RIGID PARTS (HOLES)	GO	CYL. PLUG				SEG. SPHER	ROD
	NO GO	CYL. PLUG			FULL FORM SPHER		ROD
RIGID PARTS (SHAFTS)	GO	CYL. RING					
	NO GO	GAP					
NON RIGID PARTS (SHAFTS)	GO & NO GO	CYL. RING					

APPENDIX

METRIC — SI CONVERSION TABLE

Quantity	Metric units	equivalent S.I. units	Dimension
FORCE & Weight	1 kgf	9.81 N	MLT^{-2}
TORQUE	1 kgfm	9.81 Nm	ML^2T^{-2}
Surface tension	1 dyne/cm	10^{-3} N/m	MT^{-2}
Spring stiffness	1 kgf/cm	0.981 N/mm	"
pressure, stress	1 kgf/cm^2	98.1 × 10^3 N/m^2	$ML^{-1}T^{-2}$
	1 mm of water	9.81 N/m^2	"
	1 mm of Hg	133.3 N/m^2	"
	1 atmosphere	101.3 × 10^3 N/m^2	"
Dynamic Viscosity	1 kgf sec./m^2	9.81 Ns/m^2	$ML^{-1}T^{-1}$
Kinematic Viscosity	1 cm^2/sec. (=stoke)	10^{-4} m^2/s	L^2T^{-1}
Energy, work, heat	1 erg	10^{-7} J	ML^2T^{-2}
	1 kWh	3.6 × 10^6 J	"
	1 k cal	4.187 × 10^3 J	"
	1 kgf m	9.81 J	"
Power	1 hp	746 W	ML^2T^{-3}
	1 hp (metric)	736 W	"
	1 kgf m/Sec	9.81 W	"
Temperature	°C + 273	K	θ
Specific enthalpy, latent heat, Calorific Value	1 k cal/kg	4.187 × 10^3 J/kg	L^2T^{-2}
Specific heat	k cal/kg °C	4.187 J/kg K	$L^2T^{-2}\theta^{-1}$
Specific entropy	1 k cal/kg	4.187 J/kg	L^2T^{-2}
Heat flow rate	1 k cal/m^{2}hr	1.163 W/m^2	MT^{-3}
Thermal conductivity	1 k cal/m hr °C	1.163 W/mK	$MLT^{-3}\theta^{-1}$
Heat transfer Coefft	1 k cal/m^2 hr °C	1.163 W/m^2 K	$MT^{-3}\theta^{-1}$

N, Newton — L, Length

J, Joule — M, Mass

K, Degree Kelvin — T, Time

m, metre — θ, temperature

W, Watt

kg, kilogram mass