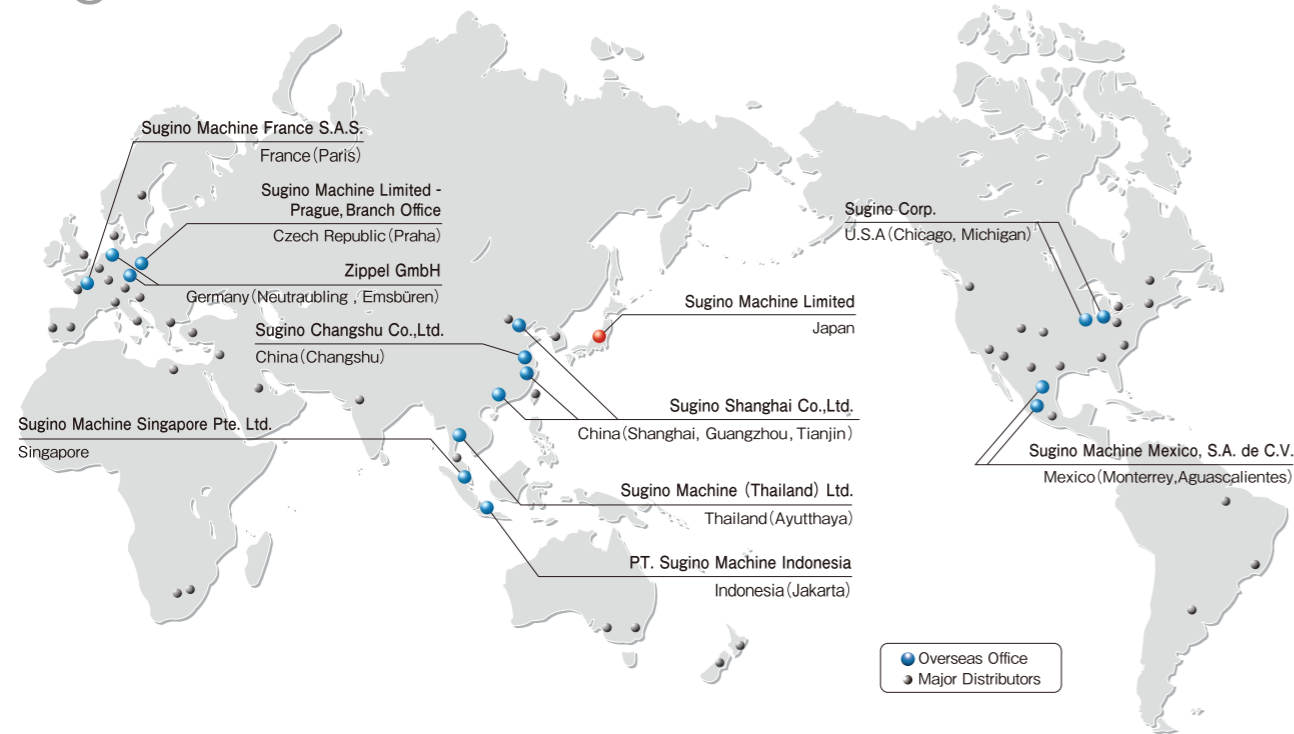


## Sugino Global Network



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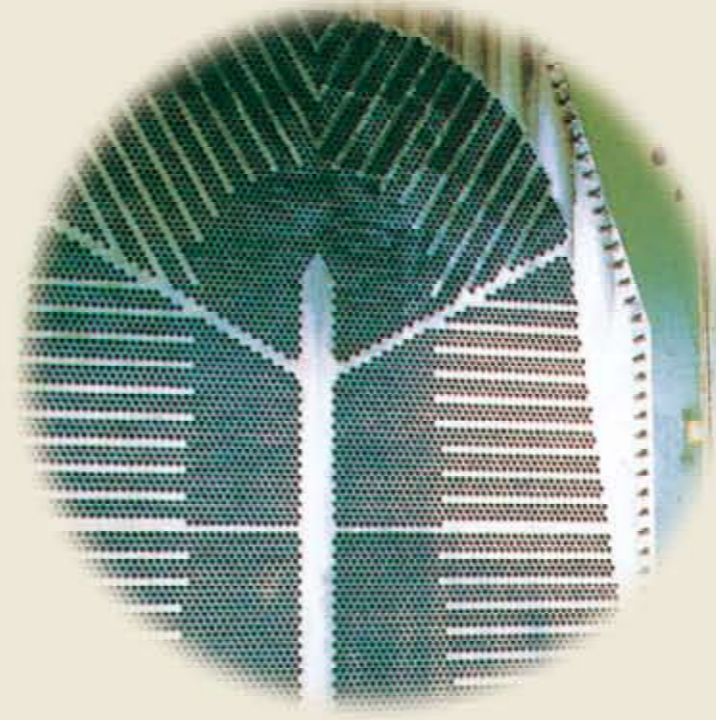
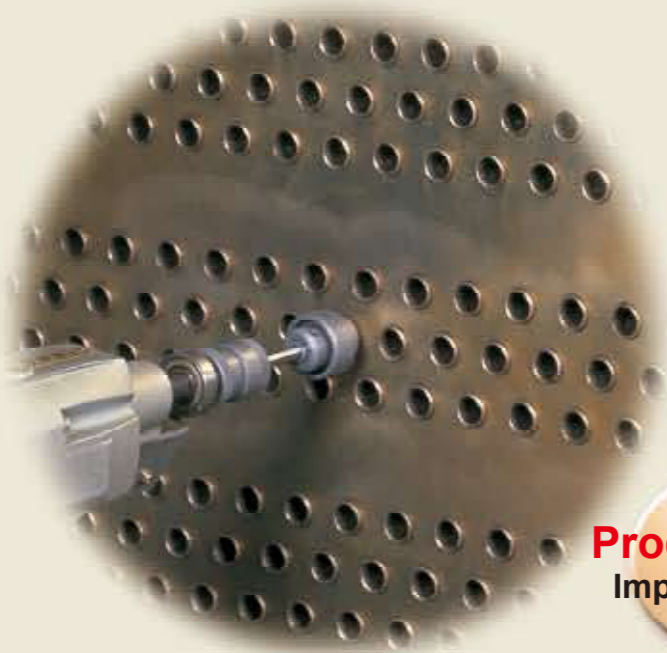
## Tube Expansion Tools for Heat Exchangers

# Tube Expanders & Accessories



# All types of tube expansion supported.

At Sugino Machine, all of the various tools needed for tube expansion work from accessories to tube expansion equipment are designed and manufactured by our firm.



Accurate Tube Expansion...  
from the Smallest Diameters to  
the Largest Diameters

## Tube Expanders

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Excellent Tube Expander  
Project Support!

## Tube Expanding Machine & Accessories

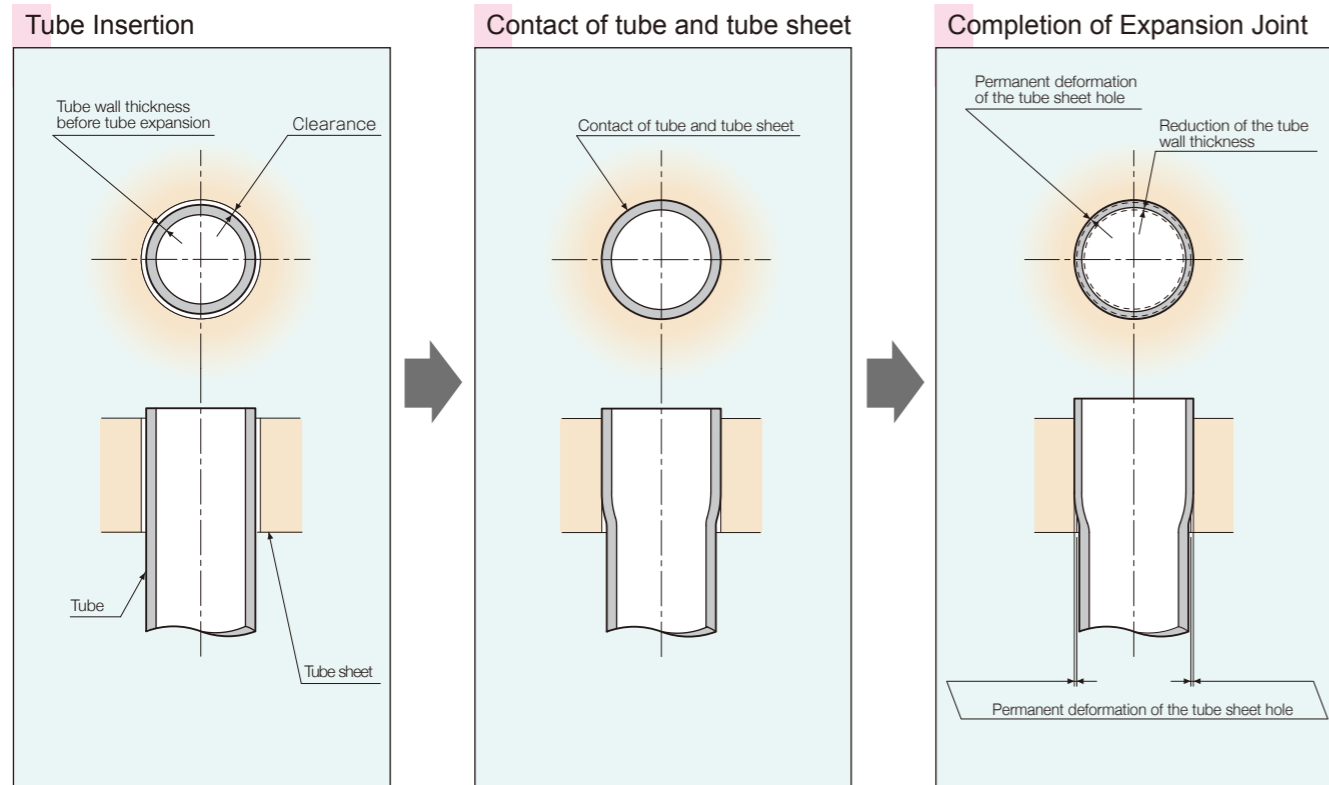
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Tube Expanders are rolling tube expansion tools to bond and mold tubes to tube sheet as part of manufacturing processes for heat exchangers, boilers, condensers, etc. Wide range of standard models to meet diverse demands. We also custom-make upon request.

### The Tube Expansion Process Using Tube Expanders

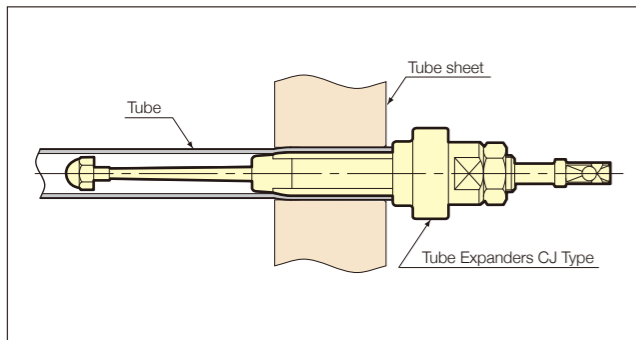


### Types of Tube Expansion

Tube expansion can be classified as "parallel tube expansion" and "flaring tube expansion."

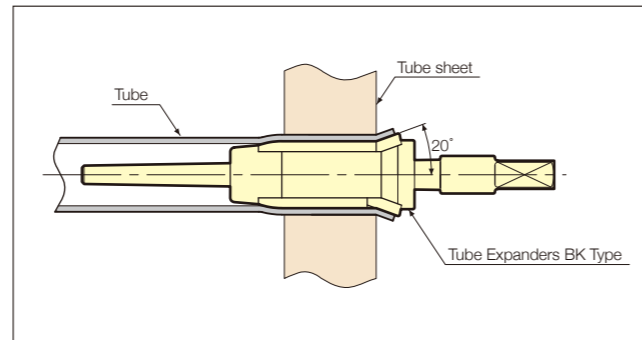
#### Parallel tube expansion

Parallel tube expansion is performed mainly with expansion of tubes for heat exchangers. In this case, the MB, CJ, CB, HJ, and HB types of tube expanders are used. (For details, please refer to page 7-11).



#### Flaring tube expansion

Flaring tube expansion is a method of tube expansion that expands the end of a tube in a flared shape and is intended for reinforcement with respect to pulling force. This is mainly performed for expansion of tubes for boilers. In this case, the BK type of tube expander is used. (For details, please refer to page 12-13).

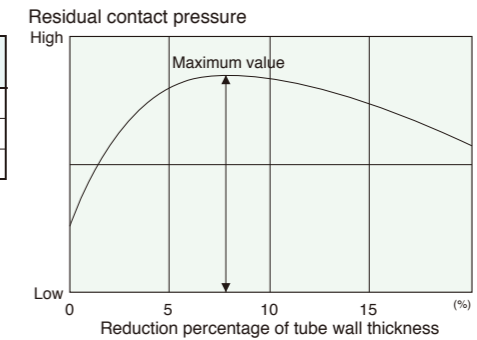


### Measurement Evaluation of Expansion Joint

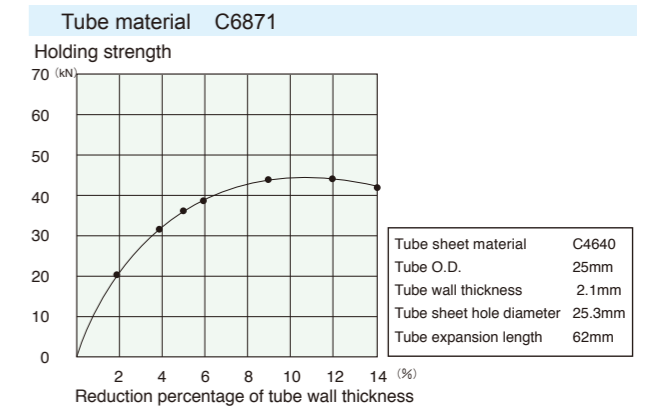
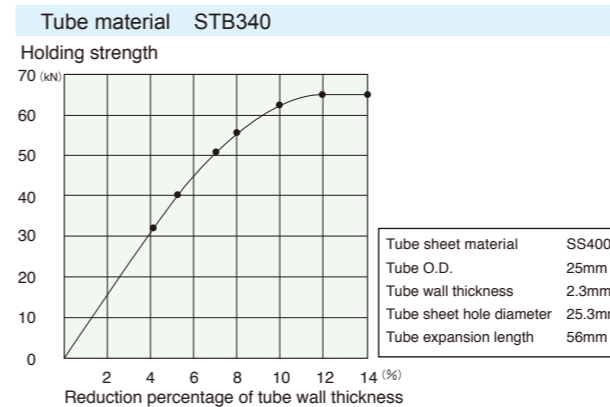
Adequate tube expansion amount with tube expanders differs depending on the tube sheet hole, Tube Outer Diameter (O.D.) individual dimensions for the tube thickness the material of the tube, and the tube sheet. There are two general methods to measure the degree of tube expansion, the "reduction percentage of tube wall thickness" and the "percentage of tube Inside Diameter (I.D.) increased".

#### Reduction percentage of tube wall thickness and residual contact pressure

Tube sheet material	Tube material	Reduction percentage of tube wall thickness(%)
Steel	Steel	7
Steel	Copper	5
Copper	Copper	10



#### Reduction percentage of tube wall thickness and holding strength



#### Formula for calculation of the reduction percentage of tube wall thickness

$$Wt = \frac{(D - d_0) - (H - d_1)}{(D - d_0)} \times 100$$

$$d_1 = H - (D - d_0) \times (1 - Wt / 100)$$

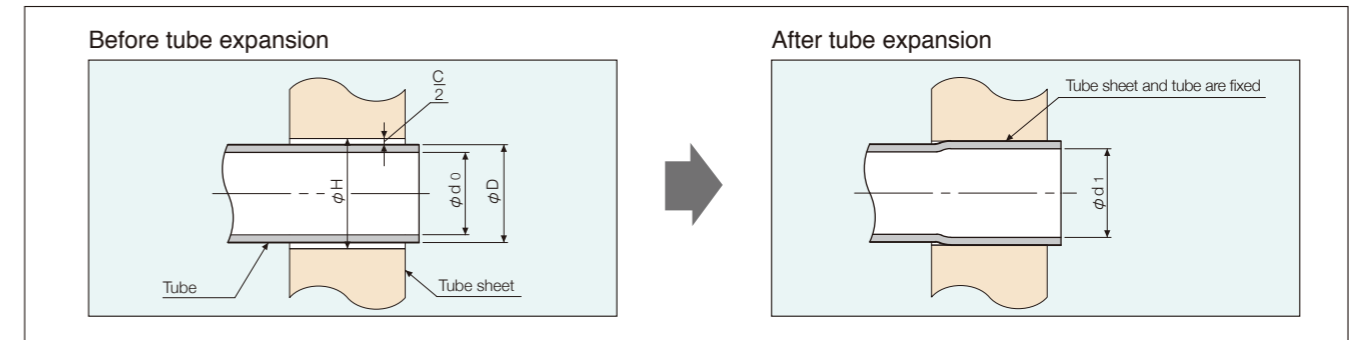
Wt : Reduction percentage of tube wall thickness(%)  
 H : Hole diameter of tube sheet before tube expansion(mm)  
 D : Tube O.D. before tube expansion(mm)  
 d<sub>0</sub> : Tube I.D. before tube expansion(mm)  
 d<sub>1</sub> : Tube I.D. after tube expansion(mm)

#### Formula for calculation of the percentage of tube I.D. increased

$$Wd = \frac{d_1 - (d_0 + C)}{(d_0 + C)} \times 100$$

$$d_1 = (d_0 + C) \times (1 + Wd / 100)$$

1-1.2 % is generally used as a guideline for Wd.  
 Wd : Percentage of tube I.D. increased(%)  
 d<sub>0</sub> : Tube I.D. before tube expansion(mm)  
 d<sub>1</sub> : Tube I.D. after tube expansion(mm)  
 C : Clearance of tube sheet hole and tube O.D.(mm)  
 (C = H - D)



Tube Expanders

Tube Expanders

## The Structure of Tube Expanders

These expanders consist of 4 major components.

### 1 Roller

This component is for plastic deformation of the internal surface of the tube with counter pressure. It has a reverse taper that conforms to the taper of the mandrel and it is designed so that the internal surface of the tube when expanded will always be perfectly circular. In addition, the ends of the rollers have a smooth R that avoids stress concentration after tube expansion and that prevents sharp angles in the internal surface of the tube.

### 2 Mandrel

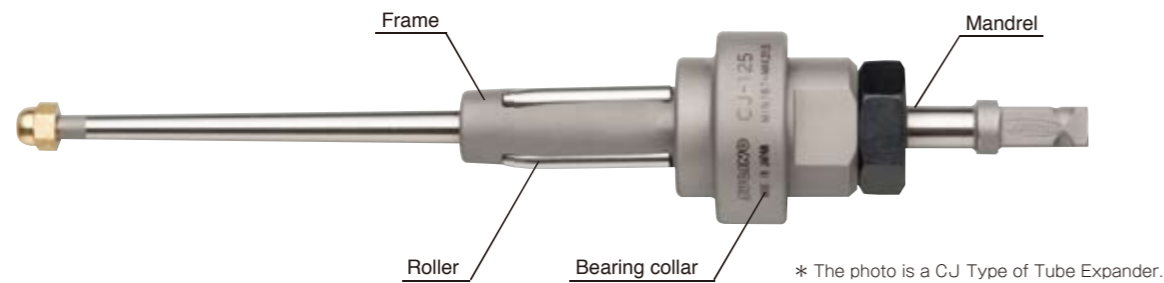
This component is for rotation of the rollers via contact friction. Like the rollers, it has a tapered shape. The rollers and mandrel use a special steel for the required resistance to pressure and friction; they have been processed with precise heat treatment and precision grinding and finishing.

### 3 Frame

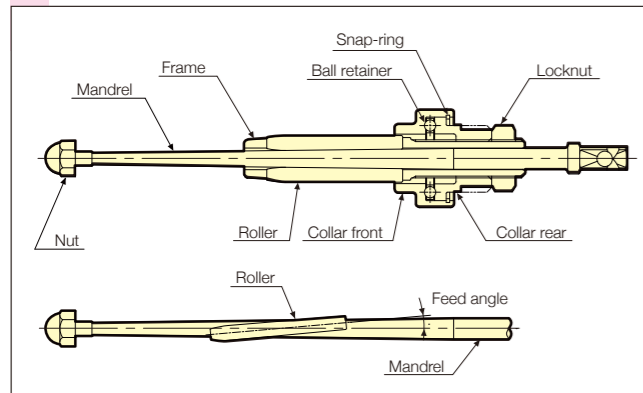
This component is for holding 3-7 rollers at equal intervals and for prevention of roller drop. There is a feed angle in the roller groove; the mandrel is self-propelled with rotation of the tool to the right, forming a structure that automatically expands the tube.

### 4 Bearing Collar

A bearing collar that prevents damage to end of tubes and tube sheets by reducing thrust during tube expansion is attached to all of the tube expanders except the BK type. The effective roller length and reach length can be adjusted as desired by adjusting the position of the bearing collar forward and backward.

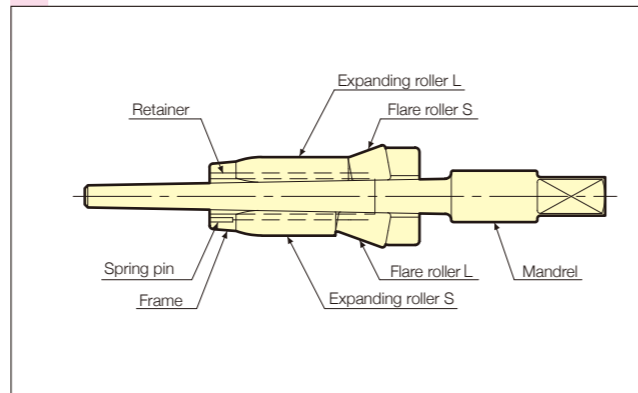


CJ Type Structural drawing



Note: The basic structure is the same for the HJ types as well.

BK Type Structural drawing



Notes 1. A spring pin and retainer are not included in BK-type expander number 38 or smaller.  
2. Three types of BK-type mandrels are available; a drum mandrel, a header mandrel, and a short mandrel. For details, please refer to page 12.

## Tube Expanders (Standard Type)

**Applications**

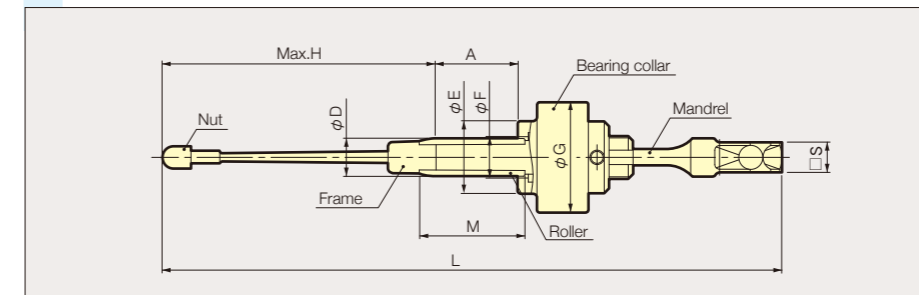
Oil coolers Pre-heaters  
Air coolers Radiators  
, etc.

**MB Type** Parallel tube expansion of ultrafine tubes can be done accurately and rapidly.

### 3-roller Type



Dimensional Drawing



Expander size table (mm)

MB Type Expander		Tube Expansion range D		Effective roller length A				Mandrel		Bearing Collar			Max. Projection Length		
Roller length M				M=13		M=25		Tool No.	Shank □S	Total Length L	E	F	G	Max.H	
Number	Number	Min.	Max.	Min.	Max.	Min.	Max.							M=13	M=25
000	—	4.2	5.2					M-0	6.3	129	11.1	5.3	19	81.5	—
00	—	4.6	5.6	0	9.5	—	—					5.7			
0	—	5.0	6.0									6.1			
1	11	5.4	6.4									6.5			
2	12	5.8	6.8	0	9.5	13	22	M-1	6.3	129	12.7	6.9	20.6	81.5	69
—	13	6.2	7.2									7.3			
—	14	6.6	7.7									7.8			
—	15	7.0	8.1	—	—	13	22	M-2	6.3	129	15.1	8.2	23	—	69
—	16	7.4	8.5									8.6			
—	17	7.8	9.0									9.1			
—	18	8.2	9.4									9.5			
—	19	8.6	9.8	—	—	13	22	M-3	6.3	128	16.7	9.9	24.6	—	68
—	20	9.0	10.2									10.3			

Note: Other sizes expanders are available upon request.



Tube expansion with tube rollers



Applications  
Condensers  
Heaters, etc.

**HJ/HB Type** Parallel tube expansion of a tube sheet thicker than 75mm or a dual tube sheet can be done accurately and rapidly.

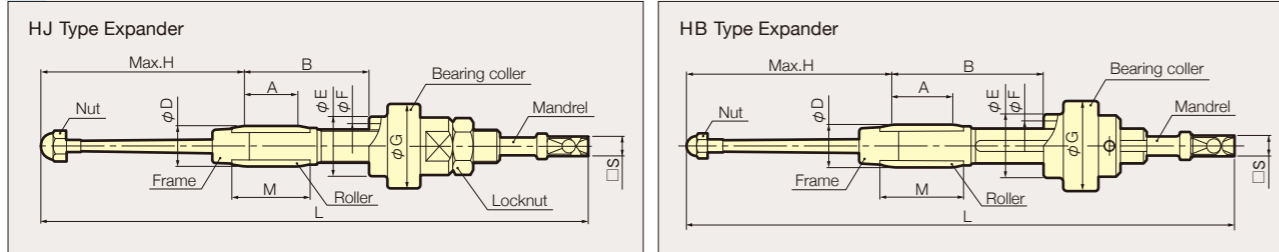
3-roller Type

HJ Type Expander

HB Type Expander



Dimensional Drawing



Expander size table (mm)

Type	Roller length M			Tube Expansion range D			Adjustable range B				Effective roller length A			Mandrel			Bearing Collar			Max. Projection Length				
	38	57	76	Max.			M=38		M=57		M=76		Tool No.	Shank □ S	Total Length L	E	F	G	Max. H					
	Number	Number	Number	M=38	M=57	M=76	Min.	Max.	Min.	Max.	Min.	Max.							M=38	M=57	M=76			
HJ	101	-	-	9.2	10.9	-	-	-	-	-	-	30	-	-	HJ 1M	9.5	349	20	11.2	30	129	-	-	
	103	-	-	10.0	11.7	-	-	14	147	-	-	-	-	-	HJ 2M	9.5	349	20	12.0	30	129	-	-	
	105	-	-	10.8	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	12.8	30	129	-	-	
	107	207	-	11.6	13.5	13.2	-	-	-	-	-	-	-	-	-	-	-	-	13.8	30	129	-	-	
	109	209	-	12.4	14.3	14.0	-	13	146	32	165	-	-	27	46	HJ 4M	9.5	350	23	14.6	33	130	111	-
	111	211	-	13.2	15.1	14.8	-	-	-	-	-	-	-	-	-	-	-	-	15.4	33	130	111	-	
	113	213	313	14.0	16.2	15.8	15.4	-	-	-	-	-	-	-	-	-	-	-	16.5	33	130	111	-	
	115	215	315	14.8	17.0	16.6	16.2	13	146	32	165	51	184	27	46	HJ 6M	9.5	351	25	17.3	38	130	111	92
	117	217	317	15.6	17.8	17.4	17.0	-	-	-	-	-	-	-	-	-	-	-	18.1	38	130	111	92	
	119	219	319	16.4	18.9	18.4	18.0	-	-	-	-	-	-	-	-	-	-	-	19.2	38	130	111	92	
	121	221	321	17.1	19.7	19.2	18.8	11	144	30	163	49	182	24	43	HJ 8M	9.5	356	29	20.0	41	136	117	98
	123	223	323	17.9	20.5	20.0	19.6	-	-	-	-	-	-	-	-	-	-	-	20.8	41	136	117	98	
	125	225	325	18.7	21.5	21.1	20.6	-	-	-	-	-	-	-	-	-	-	-	21.9	41	136	117	98	
	127	227	327	19.5	22.3	21.9	21.4	10	143	29	162	48	181	22	41	HJ10M	9.5	357	32	22.6	44	137	118	99
	129	229	329	20.3	23.1	22.6	22.1	-	-	-	-	-	-	-	-	-	-	-	23.5	44	137	118	99	
	131	231	331	21.1	23.9	23.4	22.9	-	-	-	-	-	-	-	-	-	-	-	24.3	44	137	118	99	
	132	232	332	21.5	25.0	24.4	23.8	-	-	-	-	-	-	-	-	-	-	-	25.3	44	137	118	99	
	134	234	334	22.3	25.8	25.2	24.6	-	-	-	-	-	-	-	-	-	-	-	26.1	44	137	118	99	
	136	236	336	23.1	26.5	26.0	25.4	10	141	29	160	48	179	19	38	HJ11M	12.7	367	38	26.9	52	149	130	111
	138	238	338	23.9	27.3	26.8	26.2	-	-	-	-	-	-	-	-	-	-	-	27.7	52	149	130	111	
140	240	340	24.7	28.1	27.6	27.0	-	-	-	-	-	-	-	-	-	-	-	28.5	52	149	130	111		
142	242	342	25.5	29.5	28.8	28.2	-	-	-	-	-	-	-	-	-	-	-	29.9	52	149	130	111		
144	244	344	26.3	30.3	29.6	29.0	8	139	27	158	46	177	16	35	H-12	12.7	350	43	30.7	57	151	132	113	
146	246	346	27.1	31.1	30.4	29.8	-	-	-	-	-	-	-	-	-	-	-	31.5	57	151	132	113		
148	248	348	27.9	31.9	31.2	30.6	-	-	-	-	-	-	-	-	-	-	-	32.3	57	151	132	113		
150	250	350	28.7	32.7	32.0	31.4	-	-	-	-	-	-	-	-	-	-	-	33.1	57	151	132	113		
152	252	352	29.5	34.1	33.3	32.6	-	-	-	-	-	-	-	-	-	-	-	34.5	57	151	132	113		
154	254	354	30.3	34.9	34.1	33.4	-	-	-	-	-	-	-	-	-	-	-	35.2	57	151	132	113		
156	256	356	31.1	35.7	34.9	34.2	7	138	26	157	45	176	14	33	H-13	12.7	355	48	36.0	62	157	138	119	
158	258	358	31.9	36.5	35.7	35.0	-	-	-	-	-	-	-	-	-	-	-	36.8	62	157	138	119		
160	260	360	32.6	37.2	36.5	35.7	-	-	-	-	-	-	-	-	-	-	-	37.6	62	157	138	119		
162	262	362	33.4	38.0	37.3	36.5	-	-	-	-	-	-	-	-	-	-	-	38.4	62	157	138	119		
-	264	364	35.1	-	39.7	38.9	-	-	-	-	-	-	-	-	-	-	-	40.0	62	157	138	119		
-	266	366	36.6	-	41.3	40.5	-	-	26	157	45	176	-	33	H-14	19.0	388	54	41.6	71	-	144	125	
-	268	368	38.2	-	42.9	42.1	-	-	-	-	-	-	-	-	-	-	-	43.2	71	-	144	125		
-	270	370	40.7	-	46.1	45.3	-	-	-	-	-	-	-	-	-	-	-	46.4	71	-	144	125		
-	272	372	43.9	-	49.2	48.4	-	-	24	155	43	174	-	30	H-15	19.0	408	65	49.6	81	-	166	147	
-	274	374	47.0	-	52.4	51.6	-	-	-	-	-	-	-	-	-	-	-	52.7	81	-	166	147		
-	276	376	49.5	-	55.6	54.8	-	-	-	-	-	-	-	-	-	-	-	55.9	81	-	166	147		
-	278	378	52.7	-	58.8	58.0	-	-	24	155	43	174	-	30	H-16	19.0	427	75	59.1	90	-	185	166	
-	280	380	55.9	-	61.9	61.1	-	-	-	-	-	-	-	-	-	-	-	62.3	90	-	185	166		
-	282	382	58.2	-	65.1	64.3	-	-	-	-	-	-	-	-	-	-	-	65.5	90	-	185	166		
-	284	384	61.4	-	68.3	67.5	-	-	24	155	43	174	-	30	H-17	19.0	446	84	68.6	100	-	204	185	
-	286	386	64.6	-	71.5	70.7	-	-	-	-	-	-	-	-	-	-	-	71.8	100	-	204	185		
-	288	388	67.1	-	75.4	74.5	-	-	-	-	-	-	-	-	-	-	-	75.6	100	-	204	185		
-	290	390	70.3	-	78.6	77.7	-	-	21	152	40	171	-	25	H-18	25.4	489	95	78.8	110	-	238	219	
-	292	392	73.5	-	81.8	80.9	-	-	-	-	-	-	-	-	-	-	-	82.0	110	-	238	219		
-	294	394	76.6	-	84.9	84.0	-	-	21	152	40	171	-	25	H-19	25.4	489	102	85.2	119	-	238	219	
-	296	396	79.8	-	88.1	87.3	-	-	-	-	-	-	-	-	-	-	-	88.4	119	-	238	219		
-	298	398	84.6	-	94.5	93.7	-	-	21	152	40	171	-	25	H-20	25.4	527	114	94.8	129	-	276	257	
-	300	400	90.9	-	100.8	100.0	-	-	-	-	-	-	-	-	-	-	-	101.1	129	-	276	257		

Note: Other sizes expanders are available upon request.

Applications  
Condensers  
Heaters, etc.

**HJ-E5/HB-E5 Type** Parallel tube expansion of extremely thin tubes can be done accurately and rapidly in 5 roller types.

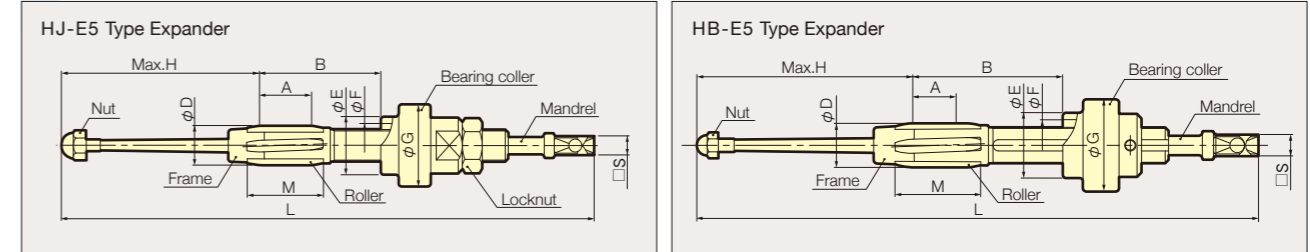
5-roller Type

HJ-E5 Type Expander

HB-E5 Type Expander



Dimensional Drawing



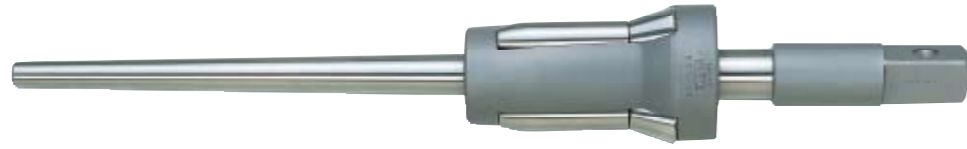
Expander size table (mm)

Type	Roller length M			Tube Expansion range D			Adjustable range B				Effective roller length A			Mandrel			Bearing Collar			Max. Projection Length				
	38	57	76	Max.			M=38		M=57		M=38	M=57	Tool No.	Shank □ S	Total Length L	E	F	G	Max. H					
	Number	Number	Number	M=38	M=57	Min.	Max.	Min.	Max.	M=38									M=57	M=38	M=57			
HJ	107E5	-	-	11.5	13.3	-	-	-	-	14	147	-	-	30	-	HJ5- 2M	9.5	360	23	13.8	-	33	139	-
	109E5	-	-	12.3	14.1	-	-	-	-	-	-	-	-	-	-	HJ5- 3M	9.5	344	23	14.6	-	33	124	-
	111E5	-	-	13.1	14.9	-	-	-	-	-	-	-	-	-	-	HJ5- 4M	9.5	365	25	15.4	-	33	124	-
	113E5	213E5	-	13.9	16.0	15.7	-	-	-	-	-	-	-	-	-	HJ5- 5M	9.5	374	25	16.5	-	38	144	125
	115E5	215E5	-	14.7	16.8	16.5	-	-	13	146	32	165	27	46	HJ5- 6M	9.5	363	29	17.3	-	41	152	133	
	117E5	217E5	-	15.5	17.8	17.5	-	-	-	-	-	-	-	-	-	HJ5- 7M	9.5	374	29	18.1	-	41	141	122
	119E5	219E5	-	16.3	18.7	18.3	-	-	-	-	-	-	-	-	-	HJ5- 8M	9.5	372	32	19.2	18.8	41	141	122
	121E5	221E5	-	17.1	19.5	19.1	-	-	-	-	-	-	-	-	-	HJ5- 9M	9.5	368	32	20.0	-	41	141	122
	123E5	223E5	-	17.9	20.5	20.1	-	-	-	-	-	-	-	-	-	HJ5- 10M	9.5	361	29	20.8	-	44	140	121
	125E5	225E5	-	18.7	21.5	21.1	-	-	11	144	30	163	24	43	HJ5- 11M	9.5	372	32	21.9	-	44	151	132	
	127E5	227E5	-	19.5	22.3	21.9	-	-	-	-	-	-	-	-	-	HJ5- 12M	9.5	368	32	22.6	-	44	151	132
	129E5	229E5	-	20.2	23.2	22.7	-	-	10	143	29	162	22	41	HJ5- 13M	9.5	368	32	23.5	-	41	148	129	
	131E5	231E5	-	21.0																				

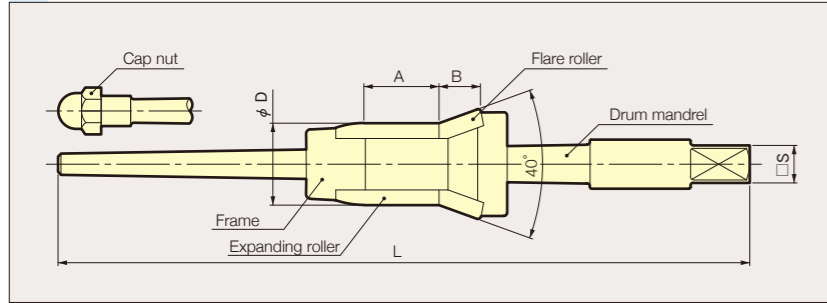
**Applications**  
 Evaporation tubes for high-pressure boilers  
 Superheater tubes  
 Water wall tubes  
 Riser tubes and downcomers, etc.  
 Support tubes  
 Fuel economizer tubes

**BK Type** Parallel tube expansion and flaring are performed in one process.

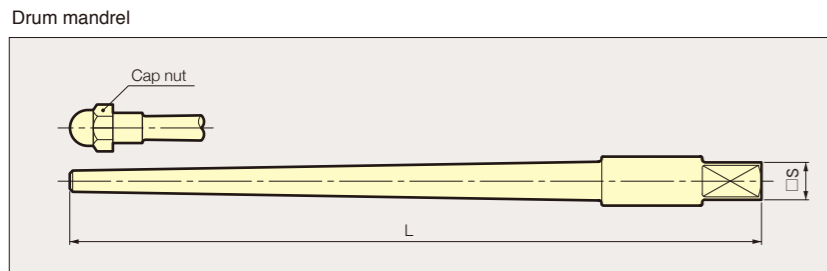
3-roller Type



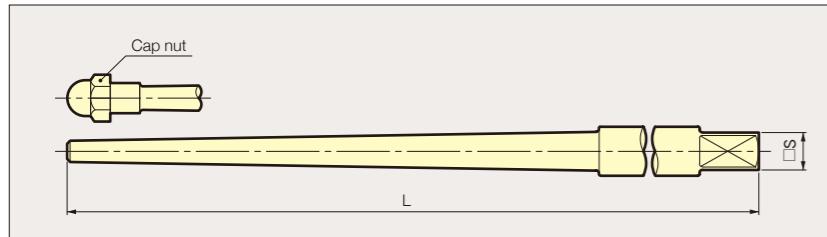
Mandrel Dimensional Drawing



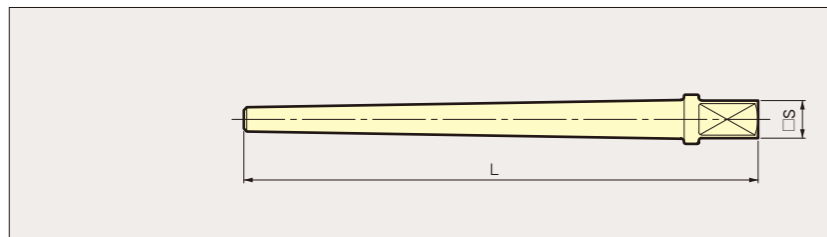
Mandrel Dimensional Drawing



Header mandrel



Short mandrel



Size Chart (mm)

Drum mandrel Tool number	Total Length L	Shank □S	Cap nut
DM- 0S	216	12.7	Yes
DM- 1S	226	12.7	
DM- 2S	256	12.7	
DM- 3 ~ 4	278	12.7	No
DM-10	329	19.0	
DM-11~15	377	19.0	
DM-16~20	377	25.4	

Size Chart (mm)

Drum mandrel Tool number	Total Length L	Shank □S	Cap nut
HM- 0S	378	12.7	Yes
HM- 1S	420	12.7	
HM- 2S	450	12.7	
HM- 3 ~ 4	430	12.7	No
HM-10	507	19.0	
HM-11~15	555	19.0	
HM-16~24	555	25.4	

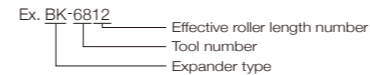
Size Chart (mm)

Drum mandrel Tool number	Total Length L	Shank □S	Cap nut
S - 3 ~ 7	132	12.7	No
SM-10~18	158	19.0	
SS-16~24	158	25.4	

Expander size table (mm)

Effective roller length A	19	25.4	32	38	44.5	51	57	63.5	70	76	83	89	95	Flare roller length B	Mandrel number		
Effective roller length number	0	1	2	3	4	5	6	7	8	9	10	11	12		Drum mandrel	Header mandrel	Short mandrel
Tool number	Tube Expansion range D														12.7	DM- 0S	HM- 0S
	Min.	Max.											DM- 1S	HM- 1S			
28	20.6	24.2	24.0	23.8	23.6	23.4	-	-	-	-	-	-			-	-	-
29	21.4	25.2	25.0	24.8	24.6	24.4	-	-	-	-	-	-	-	-	-	-	-
30	22.2	26.0	25.8	25.6	25.4	25.2	-	-	-	-	-	-	-	-	-	-	-
31	23.0	26.8	26.6	26.4	26.2	26.0	-	-	-	-	-	-	-	-	-	-	-
32	23.8	27.6	27.4	27.2	27.0	26.8	26.6	26.3	-	-	-	-	-	-	-	-	-
33	24.6	28.4	28.2	28.0	27.8	27.6	27.4	27.1	-	-	-	-	-	-	-	-	-
34	25.4	30.0	29.8	29.6	29.4	29.2	29.0	28.7	28.5	-	-	-	-	-	-	-	-
35	26.2	30.8	30.6	30.4	30.2	30.0	29.8	29.5	29.3	-	-	-	-	-	-	-	-
36	27.0	31.6	31.4	31.2	30.9	30.7	30.5	30.3	30.1	-	-	-	-	-	-	-	-
37	27.8	32.4	32.2	32.0	31.7	31.5	31.3	31.1	30.9	-	-	-	-	-	-	-	-
38	28.6	33.2	33.0	32.8	32.5	32.3	32.1	31.9	31.7	31.5	-	-	-	-	-	-	-
39	29.4	34.6	34.4	34.2	33.9	33.7	33.5	33.3	33.1	32.9	32.7	32.5	-	-	-	-	-
40	30.2	35.4	35.2	35.0	34.7	34.5	34.3	34.1	33.9	33.7	33.5	33.3	-	-	-	-	-
41	31.0	36.2	36.0	35.8	35.5	35.3	35.1	34.9	34.7	34.5	34.3	34.1	-	-	-	-	-
42	31.8	37.0	36.8	36.6	36.3	36.1	35.9	35.7	35.5	35.3	35.1	34.9	-	-	-	-	-
43	32.5	37.7	37.5	37.3	37.1	36.9	36.7	36.5	36.3	36.0	35.8	35.6	-	-	-	-	-
44	33.3	38.5	38.3	38.1	37.9	37.7	37.5	37.3	37.1	36.8	36.6	36.4	-	-	-	-	-
45	34.1	40.1	39.9	39.7	39.5	39.3	39.1	38.9	38.7	38.4	38.2	38.0	-	-	-	-	-
48	34.9	41.0	40.8	40.6	40.4	40.2	40.0	39.8	39.6	39.3	39.1	38.9	-	-	-	-	-
49	36.5	42.6	42.4	42.2	42.0	41.8	41.6	41.4	41.1	40.9	40.7	40.5	-	-	-	-	-
50	38.1	45.8	45.6	45.4	45.2	45.0	44.8	44.6	44.3	44.1	43.9	43.7	43.5	43.3	-	-	-
51	39.7	47.4	47.2	47.0	46.8	46.6	46.4	46.2	45.9	45.7	45.5	45.3	45.1	44.9	-	-	-
52	41.3	49.0	48.8	48.6	48.4	48.2	47.9	47.7	47.5	47.3	47.1	46.9	46.7	46.5	-	-	-
53	42.9	50.6	50.4	50.2	50.0	49.8	49.5	49.3	49.1	48.9	48.7	48.5	48.3	48.1	-	-	-
54	44.5	52.2	52.0	51.8	51.6	51.4	51.1	50.9	50.7	50.5	50.3	50.1	49.9	49.7	-	-	-
55	46.0	53.8	53.6	53.4	53.1	52.9	52.7	52.5	52.3	52.1	51.9	51.7	51.5	51.3	-	-	-
56	47.6	55.3	55.1	54.9	54.7	54.5	54.3	54.1	53.9	53.7	53.5	53.2	53.0	52.8	-	-	-
57	49.2	56.9	56.7	56.5	56.3	56.1	55.9	55.7	55.5	55.3	55.1	54.8	54.6	54.4	-	-	-
58	50.8	58.5	58.3	58.1	57.9	57.7	57.5	57.3	57.1	56.8	56.6	56.4	56.2	56.0	-	-	-
59	52.4	60.1	59.9	59.7	59.5	59.3	59.1	58.9	58.6	58.4	58.2	58.0	57.8	57.6	-	-	-
60	54.0	61.7	61.5	61.3	61.1	60.9	60.6	60.4	60.2	60.0	59.8	59.6	59.4	59.2	-	-	-
61	55.6	63.3	63.1	62.9	62.7	62.5	62.2	62.0	61.8	61.6	61.4	61.2	61.0	60.8	-	-	-
62	57.2	-	66.0	65.8	65.5	65.3	65.1	64.8	64.6	64.4	64.1	63.9	63.7	63.5	-	-	-
63	58.7	-	67.6	67.4	67.1	66.9	66.7	66.4	66.2	65.9	65.7	65.5	65.2	65.0	-	-	-
64	60.3	-	69.2	69.0	68.7	68.5	68.3	68.0	67.8	67.5	67.3	67.1	66.8	66.6	-	-	-
65	61.9	-	70.8	70.5	70.3	70.1	69.8	69.6	69.4	69.1	68.9	68.7	68.4	68.2	-	-	-
66	63.5	-	72.3	72.1	71.9	71.6	71.4	71.2	70.9	70.7	70.5	70.2	70.0	69.8	-	-	-
67	65.1	-	73.9	73.7	73.5	73.2	73.0	72.8	72.5	72.3	72.0	71.8	71.6	71.4	-	-	-
68	66.7	-	75.5	75.3	75.0	74.8	74.6	74.3	74.1	73.9	73.6	73.4	73.2	73.0	-	-	-
69	68.3	-	77.1	76.9	76.6	76.4	76.2	75.9	75.7	75.5	75.2	75.0	74.8	74.6	-	-	-
70	69.9	-	78.7	78.5	78.2	78.0	77.8	77.5	77.3	77.0	76.8	76.6	76.3	76.1	-	-	-
71	71.4	-	80.3	80.1	79.8	79.6	79.4	79.1	78.9	78.6	78.4	78.2	77.9	77.7	-	-	-
72	73.0	-	81.9	81.6	81.4	81.2	80.9	80.7	80.5	80.2	80.0	79.8	79.5	79.3	-	-	-
73	74.6	-	83.5	83.2	83.0	82.8	82.5	82.3	82.1	81.8	81.6	81.4	81.1	80.9	-	-	-
74	76.2	-	86.3	86.1	85.8	85.5	85.3	85.0	84.7	84.5	84.2	84.0	83.7	83.5	-	-	-
75	77.8	-	87.9	87.6	87.4	87.1	86.9	86.6	86.3	86.1	85.8	85.5	85.3	85.0	-	-	-
76	79.4	-	89.5	89.2	89.0	88.7	88.5	88.2	87.9	87.7	87.4	87.1	86.9	86.6	-	-	-
77	81.0	-	91.1	90.8	90.6	90.3	90.0	89.8	89.5	89.2	89.0	88.7	88.4	88.2	-	-	-
78	82.6	-	92.7	92.4	92.1	91.9	91.6	91.4	91.1	90.8	90.6	90.3	90.0	89.8	-	-	-
79	84.1	-	94.3	94.0	93.7	93.5	93.2	92.9	92.7	92.4	92.1	91.9	91.6	91.3	-	-	-
80	85.7	-	95.9	95.6	95.3	95.1	94.8	94.5	94.3	94.0	93.7	93.5	93.2	93.0	-	-	-
81	87.3	-	97.4	97.2	96.9	96.6	96.4	96.1	95.8	95.6	95.3	95.1	94.8	94.6	-	-	-
82	88.9	-	99.0	98.8	98.5	98.2	98.0	97.7	97.4	97.2	96.9	96.7	96.4	96.2	-	-	-
83	90.5	-	100.6	100.3	100.1	99.8	99.6	99.3	99.0	98.8	98.5	98.2	98.0	97.7	-	-	-
84	92.1	-	102.2	101.9	101.7	101.4	101.2	100.9	100.6	100.4	100.1	99.8	99.6	99.4	-	-	-

- Notes 1. The short mandrel is used in BK-type tube expanders with an effective roller length number 0-4. Short mandrels for BK-type tube expanders with an effective roller length number 5 or greater are custom-made.
- 2. BK type expander with greater tool number has a retainer in the frame; the rollers will not fall out even if the mandrel is removed.
- 3. Other expander sizes are available upon request.
- 4. Examples of BK-type tube expanders

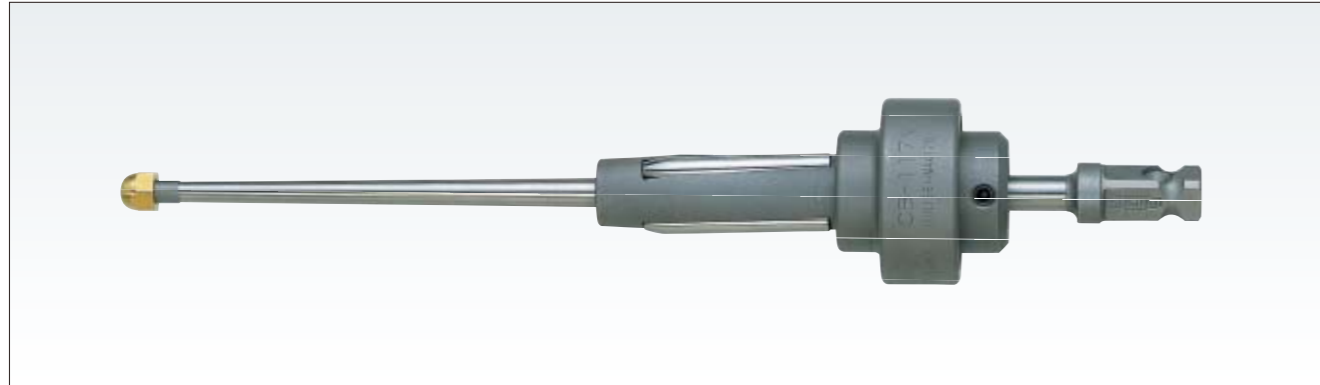


## Tube Expanders (Special Type)

Custom-made Expander.  
For Expander of your special requirement, please feel free to contact us at your nearest Sugino office.

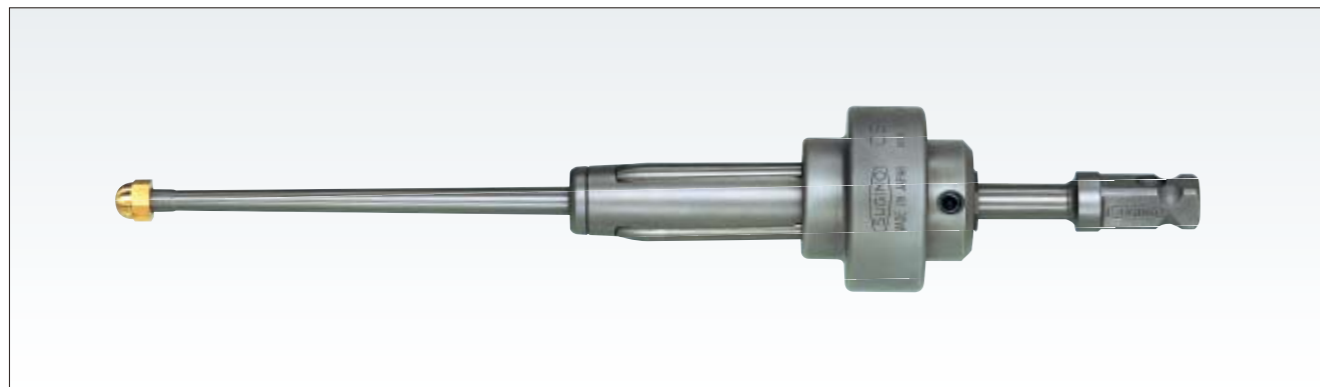
### High-speed Expander (MB-V Type, CJ-V type, CB-V type, HJ-V Type, HB-V Type)

These tube expanders can greatly reduce tube expansion time through a larger feed angle. Work efficiency can be greatly improved.



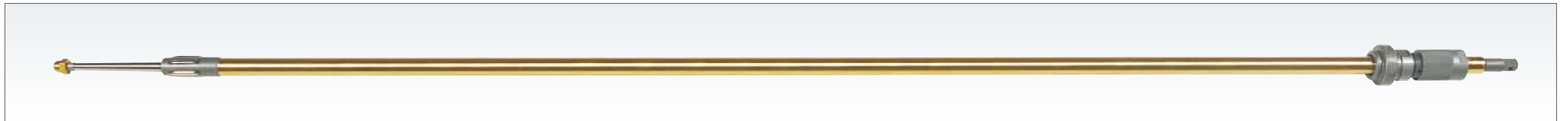
### ECOEXPANDER™ (MB-W Type, CJ-W type, CB-W type, HJ-W Type, HB-W Type)

These tube expanders can perform non-lubricated tube expansion thanks to Sugino's special metal surface modification treatment. They are suitable for thin titanium tube and brass tube ; the cost reduction and quality improvement can be realized simultaneously.



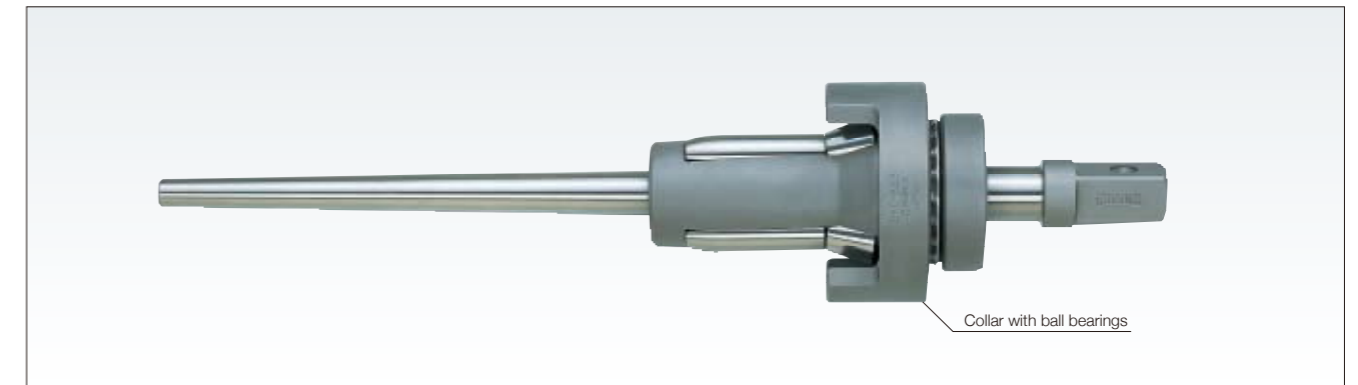
### Long-reach Expander LHB Type

These tube expanders are used for large heat exchangers and baffle plates. They can be manufactured with a maximum length of up to 5 m as the option.



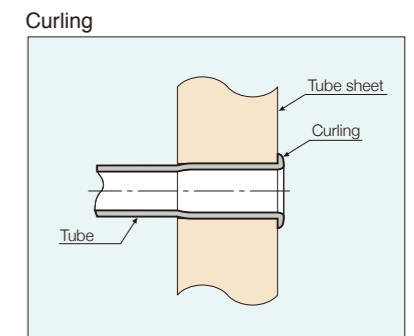
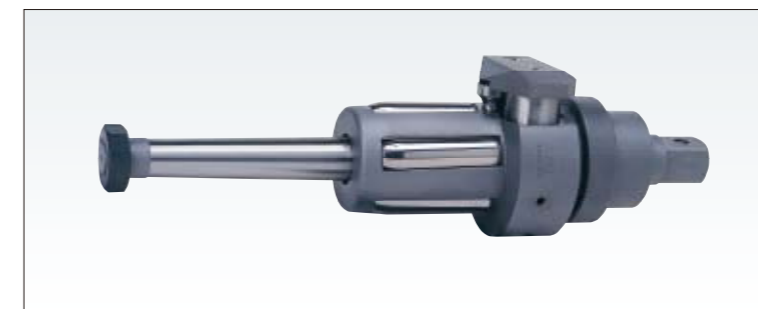
### Tube Expander BKC Type

Constant parallel tube expansion and flaring can be performed with these tube expanders in one process by using a collar with ball bearings.



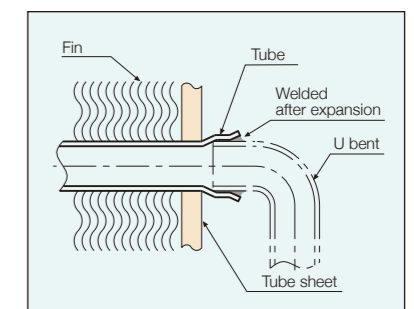
### Curling Expander FB Type

These tube expanders are used for smoke-tube boilers (in the firebox). Processing time can be greatly reduced because parallel tube expansion and curling can be performed at the same time.



### Tube end forming expander

Tube End Forming Expander is a special expander for expanding or enlarging copper tube end in order to insert and connect another tube end. It is mainly used on air cooler or small boiler.



Tube Expanders (Special Type)

Tube Expanders (Special Type)



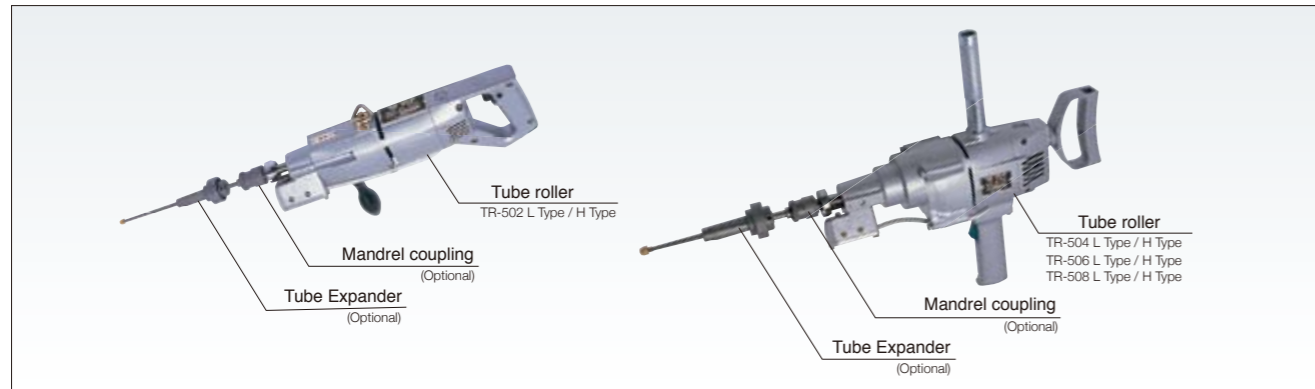
# Tube Expanding Machine & Accessories

## Eledrive (Electric Torque Control Equipment)

This is the most common tube expansion equipment using electricity as the driving source. It electrically detects the load torque during tube expansion and automatically controls tube expansion to the size which was selected.

### Tube roller

This is a driving unit for tube expansion. It performs clockwise rotation, stopping, and counterclockwise rotation. 8 types of tube rollers are available depending on differences in the tube expansion capacity.

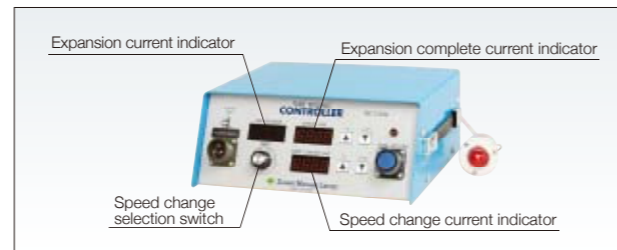


### Control box

This device is to control tube expansion work constant. Current value can be set in two stages as part of tube expansion, tube expansion precision remarkably improves.

#### Standard Accessories

- ① Controller ..... 1 unit
- ② Electrical cord 100 V or 200/220 V (10 m) ..... 1 pc.
- ③ Expansion complete indicator lamp (10m) ..... 1 pc.
- ④ Ground cord (2 m) ..... 1 pc.
- ⑤ Storage box ..... 1 pc.



### Specification Chart

Capacity (The standard of tube O.D.)		Tube roller										Control box						
Steel / Stainless steel / mm	Copper / mm	Tool No.	No-load		Full load			Maximum load			Weight / kg	Spindle size / mm	Tool No.	Units for set current / A	Max. current value for set / A	Range of input voltage / V	Dimensions / mm	Weight / kg
			Current / A	Speed / min <sup>-1</sup>	Current / A	Speed / min <sup>-1</sup>	Torque / N·m	Current / A	Speed / min <sup>-1</sup>	Torque / N·m								
10~19	10~25	TR-502L	2.3	600	5.0	285	7.5	5.7	270	8.7	5.8	□ 9.5	TRC-1022S10	0.01	12.00	Single Phase AC100 (±10%) 50/60Hz	300 W x 285 L x 120 H	12
		TR-502H		1,000		500	4.5		470	5.5								
16~25	19~38	TR-504L	2.8	410	8.0	240	15.5	9.0	230	18.0	8.5	□ 12.7	TRC-1022S22	0.01	12.00	Single Phase AC200 / 220 (±10%) 50/60Hz	300 W x 285 L x 120 H	12
		TR-504H		820		480	8.0		450	9.3								
25~38	25~51	TR-506L	2.9	350	10.0	180	30.0	11.0	175	34.0	10.0	□ 19	TRC-1022S22	0.01	12.00	Single Phase AC200 / 220 (±10%) 50/60Hz	300 W x 285 L x 120 H	12
		TR-506H		700		350	14.5		330	16.5								
38~50	38~70	TR-508L	2.9	90	10.0	40	110	11.0	37	123	12.0	□ 19	TRC-1022S22	0.01	12.00	Single Phase AC200 / 220 (±10%) 50/60Hz	300 W x 285 L x 120 H	12
		TR-508H		175		80	54.0		75	62.0								

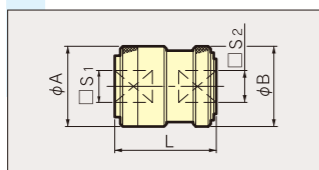
Notes 1. Expansion capacity differs depending on various conditions of tube expansion. Please inform us the detailed conditions of tube expansion.  
 2. Please select the model of Control Box according to the voltage in use.  
 3. Please use only an input voltage for this product which is within the range of above table. Voltage transformer must be used if the input voltage is different from above table.

## Mandrel Coupling (For Eledrive. For Servodrive. For Mechadrive.)

This is an attachment for connection of a driving unit and a tube expander.



### Dimensional Drawing

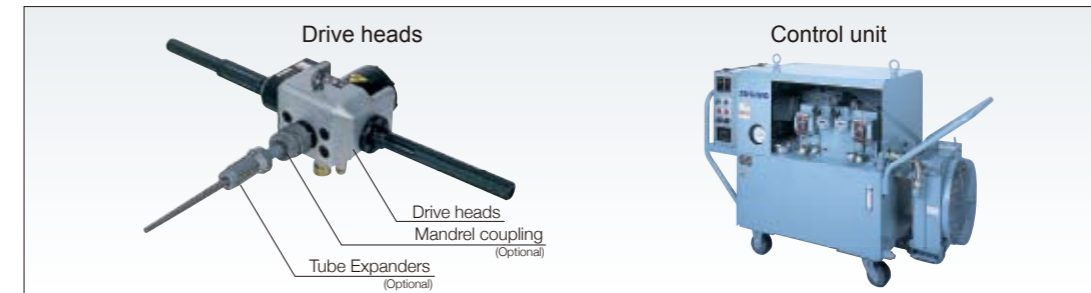


### Size table (mm)

Tool No.	Dimensions				
	A	B	L	□S1	□S2
MC-22	23	23	33	6.3	6.3
MC-32	29	26	37	9.5	6.3
MC-33	29	29	41	9.5	9.5
MC-43	32	29	41	12.7	9.5
MC-44	32	32	41	12.7	12.7
MC-63	48	43	53	19.0	9.5
MC-64	48	43	53	19.0	12.7
MC-66	48	48	66	19.0	19.0
MC-86	60	48	88	25.4	19.0

## Hydrive (Hydraulic-driven Torque Control Unit)

Hydraulic-driven torque control unit to expand thick and large-diameter tubes. It's compact and high torque design ensures constant expansion through out the whole process. The Control unit is capable of operating 2 Drive heads at the same time, each outlet is equipped with its own individual digital switch for different settings of expansion pressure.



### Specification Chart

Capacity (The standard of tube O.D.)	Hydrive												
	Drive heads					Control unit							
	Steel / Copper / mm	Tool No.	Torque / N·m	Speed / min <sup>-1</sup>	Weight / kg	Spindle size / mm	Tool No.	Number of attachable drive heads	Electric motor			Weight / kg	
Output / kW									Number of poles / P	Voltage / V	Rated current / A		
32~76	OM-46	200	0~200 (50Hz) 240 (60Hz)	12	φ25	OMC-246CH-D	Max.2	15	4	3-phase AC200	56	54	550 (Does not include working oil)
50~100	OM-68	400	0~110 (50Hz) 130 (60Hz)	24	φ31.8					3-phase AC220	—	50	
90~125	OM-68S	650	0~60 (50Hz) 72 (60Hz)	25	φ31.8					3-phase AC220	—	50	

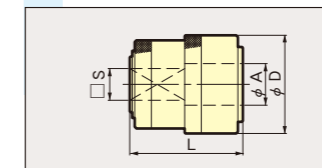
Note 1. Expansion capacity differs depending on various conditions of tube expansion. Please inform us the detailed conditions of tube expansion.  
 2. Please use only an input voltage for this product which is within the range of above table. Voltage transformer must be used if the input voltage is different from above table.

## Mandrel Coupling (For Hydrive)

This is an attachment for connection of a driving unit and a tube expander.



### Dimensional Drawing



### Size table (mm)

Tool No.	Dimensions			
	□S	A	D	L
MC-804	12.7	25	59	57
MC-806	19.0	25	59	68
MC-806E	19.0	31.8	66	63
MC-808E	25.4	31.8	66	63

## Spring Balancer

The Spring Balancer hangs up expansion unit, driving device, and so on. The burden of the operator can be greatly reduced.



### Size table (kg)

Tool No.	Weight capacity
NO.3	4.5 ~ 9
NO.4	9 ~ 15
NO.5	15 ~ 22
NO.6	22 ~ 30
NO.7	30 ~ 40
NO.8	40 ~ 50

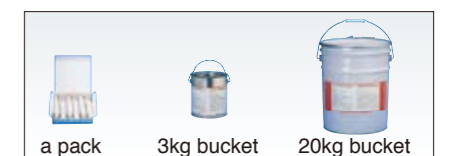
## Expander Oil

Water-soluble lubrication oil. Stops wear of Tube Expander and extend life of the tool. There are 2 types of oil; one type is for expanding steel tubes and the other is for expanding copper tubes. 1-liter and 18-liter tin can are available. The standard diluting ratio of Water to Oil is (20: 1)



## Expander Cream

Water soluble and paste type lubrication cream specially formulated for tube expansion. Its unique characteristics make it suitable for all types of tube materials. 3 types of containers for many purposes; a pack (170g tube x 6pcs), 3kg bucket, and 20kg bucket.



**Servodrive** (Servomotor-driven, torque control tube expanding machine)

Servodrive is a high precision and high speed expansion machine, using servomotor as the driving source. This machine can save the tube expansion time remarkably because it can set the number of revolution individually for when expanding tubes and when reverse rotating (returning). Besides, this can record the data such as tube expanding condition, spindle speed and torque, etc. to SD card.



■ A complete set of Servodrive

- ① Servodrive (with Controller and cable) ... 1 unit
- ② Mechastand ..... 1 unit
- ③ Telesco-Hand ..... 1 unit
- ④ Foot Switch ..... 1 pc.
- ⑤ Power Cable (10m) ..... 1 pc.

Specification Chart

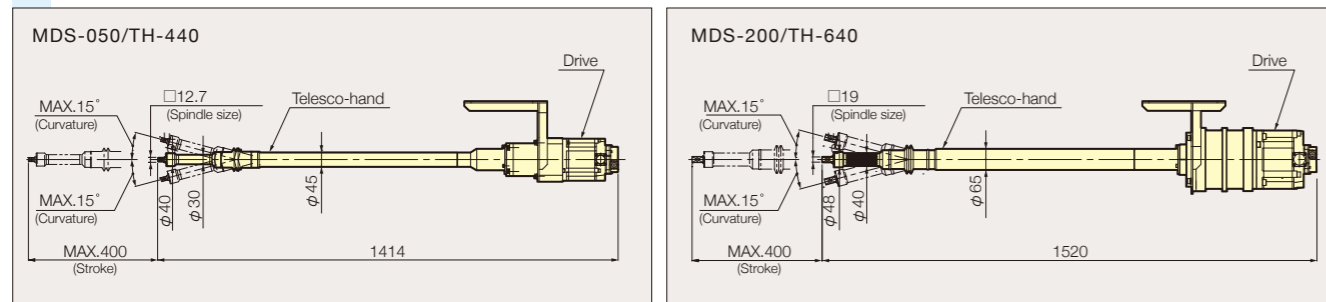
Servo Drive(With Controller)								
Model No.	Capacity (The standard of tube O.D.) mm	Range of torque control N · m	Speed min <sup>-1</sup>	Motor	Voltage	Power capacity kVA	Weight	
							Drive kg	Controller kg
MDS-050	16~38.1	5~50	1~750	1.8kW AC Servo Motor	3-phase AC200~230V 50/60Hz	4	22	28
MDS-200	25.4~76.2	40~200		4.4kW AC Servo Motor		7.5	57	44

Telesco-hand					Mechastand					
Model No.	Stroke mm	Curvature degrees	Weight kg	Spindle size mm	Model No.	Workable range		Dimensions mm	Weight kg	Available Servo Drive
						X axis mm	Y axis mm			
TH-440	400	15	6	□12.7	MS-0808WS	Max.800	Max.800	1,100W×750L×1,600H	120	MDS-050
TH-640	400	15	12.5	□19	MS-1010S	Max.1,000	Max.1,000	1,400W×1,000L×1,830H	200	

Notes 1. The workable range of the Mechastand is the value when the telescopic hand is attached.  
 2. Special type Mechastand which is not in the above chart is available as an option. Please contact your local Sugino sales staff.  
 3. Expansion capacity differs depending on the tube expanding conditions. Please inform us the condition when you inquire it.  
 4. Transformer is required when operating this machine in the area where input voltage is different from above chart.

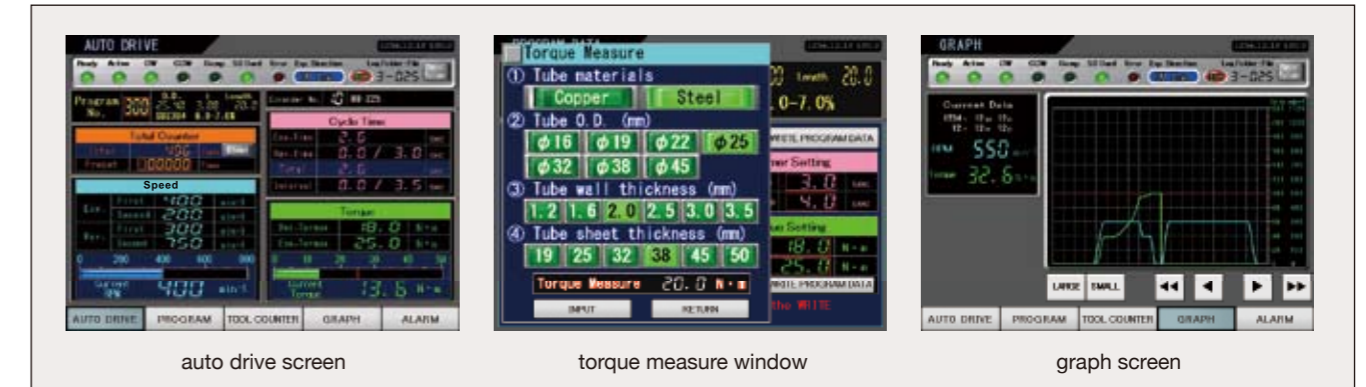
Dimensional Drawing



control unit touch panel screen

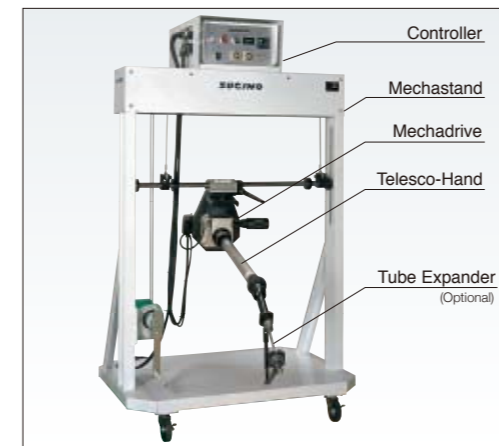
Servodrive can register tube expanding condition such as spindle speed, expansion torque, etc. by Sugino original program(Max. 300 ways).This program is easy to arrange because tube size, material and other information can be registered for each program.

Tube expanding torque indicator supports users, and even beginners can create the program.



**Mechadrive** (Electric motor-driven, torque control tube expanding machine)

Automatic tube expansion machine suitable for heat exchanger. Its low resistance design and highly accurate torque control system make expanding jobs so easy that even a beginner can do it like an expert.



■ A complete set of Mechadrive

- ① Mechadrive (with cable) ... 1 unit
- ② Mechastand ..... 1 unit
- ③ Controller ..... 1 unit
- ④ Telesco-Hand ..... 1 unit
- ⑤ Foot Switch ..... 1 pc.
- ⑥ Power Cable (10m) ..... 1 pc.

**Double-head Mechadrive** (Optional)

This machine can expand 2 tubes at the same time. It decreases cycle time drastically.



Specification Chart

Capacity (The standard of tube O.D.)		Mechadrive								
Steel mm	Copper mm	Model No.	Range of torque control N · m	Speed min <sup>-1</sup>	Output kW	Number of poles P	Voltage V	Rated current		Weight kg
								50Hz A	60Hz A	
12.7~38.1	12.7~45.0	MD-0250V	0.2~50	150~900 (50Hz/60Hz common)	1.5	4	3ph AC200 3ph AC220	9.9 —	8.9 8.6	30

Mechastand					Telesco-hand				
Model No.	Workable range		Dimensions (With Controller) mm	Weight (With Controller) kg	Model No.	Stroke mm	Curvature degrees	Weight kg	Spindle size mm
	X axis mm	Y axis mm							
MS-0808W	Max. 800	Max. 800	1,100 W x 750 L x 1,600 H	120	TH-440	400	15	6	□12.7
MS-1010	Max.1,000	Max.1,000	1,400 W x 1,000 L x 1,830 H	200					

Notes 1. The workable range of the Mechastand is the value when the telescopic hand is attached.  
 2. Special type Mechadrive other than those listed above is available as the option. Please contact your local Sugino sales staff.  
 3. Expansion capacity differs depending on various conditions during tube expansion. Please inform us of the various conditions during tube expansion.  
 4. Voltage transformer is required when operating in the area where input voltage is different from motor's standard specification.

### Aqua Setter Aquozu (Ultra High Liquid Pressure Tube Expansion machine)

Aquozu is a tube expansion machine which expands tubes by ultra-high pressured water and servomotor is installed as a driving source. Ultra-high pressured water works inside a tube and this makes the tube fixing to the tube sheet by a plastic deformation. This machine is suitable for thick and/or long tube expansion.

#### Gun unit



Gun unit supplies ultra-high pressured water into Aqua Mandrel as necessary. The weight was reduced from the conventional one.

#### Specification Chart (ASG)

Tube Expansion Range (Referential tube I.D.) Steel / Copper	Model No.	Working pressure	Dimensions	Weight
mm		MPa	mm	kg
10~46	ASG-35S	100~350	38 W x 190 L x 190 H	1.2

Note: Tube Expansion Range may change, depending on various expansion conditions. Please provide us detail information of the application tube for further confirmation.

#### Control unit



Control unit controls the pressure of ultra-high pressured water as necessary. Since servomotor is installed for the pressure generator, it achieved shorter expansion time, cleaner working environment and easier maintenance.

#### Specification Chart (ASC)

Model No.	Discharge pressure	Flow rate	Air pressure	Electric motor		Dimensions	Weight
				output	Voltage		
	MPa	mL/STR.	MPa	kW	V	mm	kg
ASC-3517S	100~350	17	0.5~0.6	1.8	3-phase AC 200~230 50/60Hz	480 W x 585 L x 1,100 H	200

Note: Please use only an input voltage for the controller unit which is within the range of above table. Voltage transformer must be used if the input voltage is different from above table.

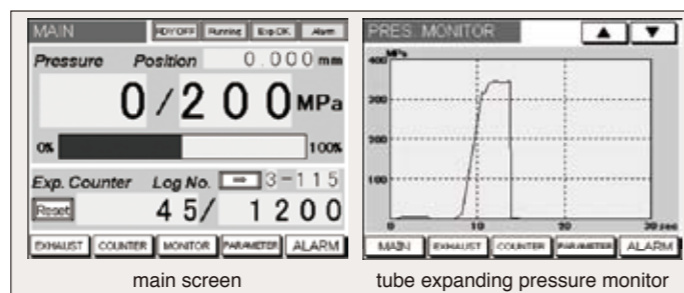
#### Connection and Accesories



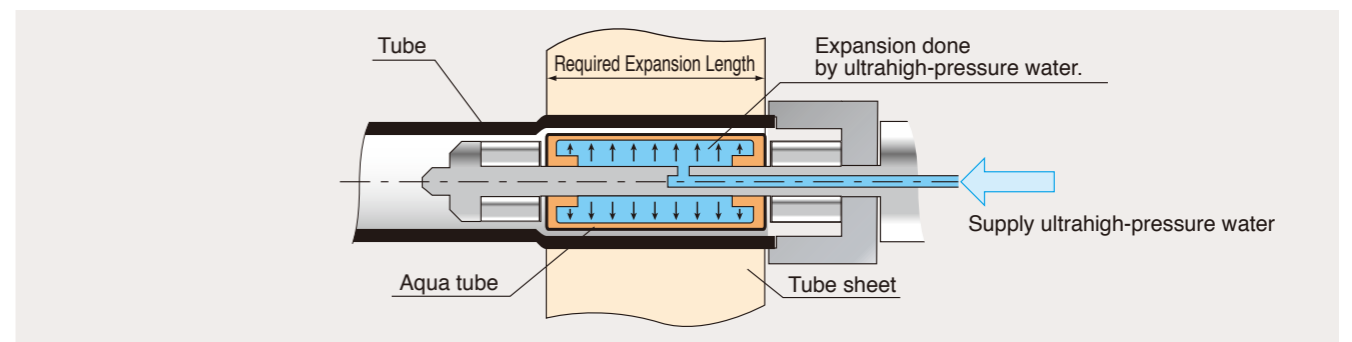
#### A Complete set of Aqua Setter Aquozu

- ① Gun Unit ..... 1 unit
- ② Control Unit ..... 1 unit
- ③ Hose ASS'Y (6m) ..... 1 pc.
- ④ Power cable (10m) ..... 1 pc.
- ⑤ Disassembling Tools ..... 1 set

#### Control unit touch panel screen



### Principle of Liquid Pressure Tube Expansion



#### Feature

- **Environment Friendly** ..... Water-assisted, clean, environment-friendly tube expansion. Work environment improved with oil leak-free servomotor.
- **Economical** ..... With its ability to expand 800mm in a single expansion, Aqua Setter Eco greatly reduce the expansion time and total cost.
- **Easy Operation** ..... Even thick tube can be expanded at your fingertips. Foolproof equipment with touch-screen system.
- **Safety** ..... As no resistance force is generating during expansion, it improves safety of operation.
- **Improve Quality** ..... No tube deformation and tube inner diameter hardening/flaking is generated.

#### Expansion Example

	Tube material: STBA23 Tube size: O.D.50.8×t 4.6 Tube sheet material: S45C Expansion length: 555mm Working pressure: 190MPa Groove size: —
	Tube material: SUS304TP Tube size: O.D.25.4×t 2.0 Tube sheet material: S45C Expansion length: 45mm Working pressure: 300MPa Groove size: Double groove
	Tube material: C6871 Tube size: O.D.25.4×t 1.8 Tube sheet material: SS400 Expansion length: 45mm Working pressure: 200MPa Groove size: Double groove
	Tube material: SUS304 Tube size: O.D.12×t 1.0 Tube sheet material: SUS304 Expansion length: 30mm Working pressure: 200MPa Groove size: —

## Grooving Tool

This tool is to perform grooving in the internal surface of the tube sheet hole.  
It can be attached with a drilling machine and multiple groove can be easily performed in 1 process.

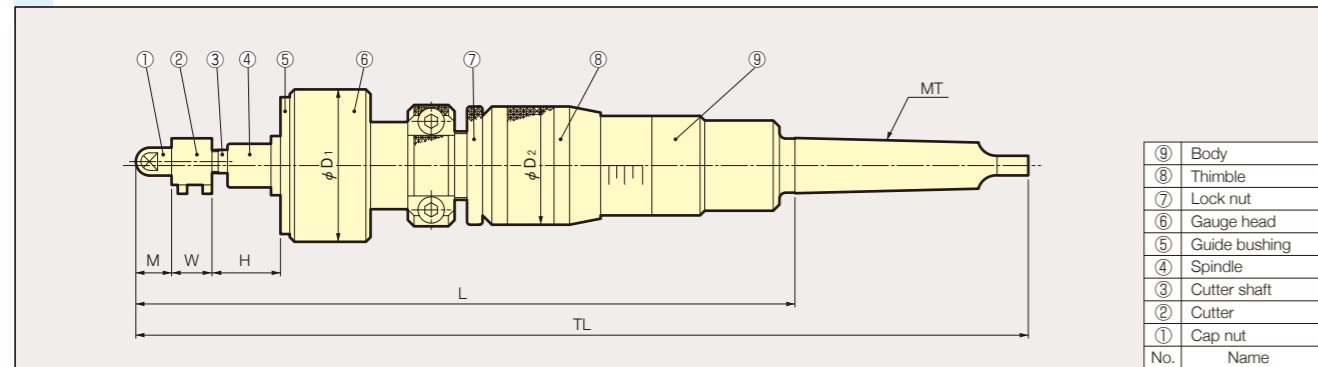


### Specification Chart

Tool No.	Applicable hole diameter mm	Maximum groove depth mm	Maximum groove width mm	Dimension H from face to groove mm	Weight kg
GT-102	10 ~14	0.8	6	4~20	1.1
GT-122	12.7~17	1.3	6	4~20	1.1
GT-162	16 ~21	1.3	6	4~20	1.2
GT-193	19 ~32	2.3	8	6~30	2.2
GT-303	30 ~54	3.7	8	6~40	3.7
GT-504	50 ~78	6.2 (3.2)	8	6~60	8.6

Notes 1. The numbers in ( ) are values when the hole diameter is 64~78 mm.  
2. When the hole diameter is within the range 64~78mm, the cutter is composed of Bite Holder and Bite.  
3. The dimension from opening face to groove is the H dimension in the dimensional drawing below.

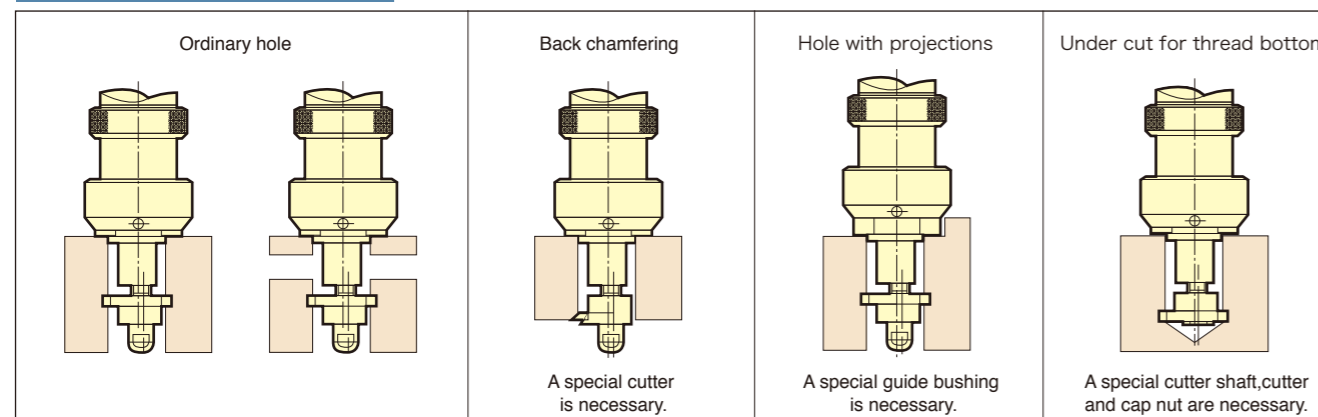
### Dimensional Drawing



### Size table (mm)

Tool No.	Cutter width	Cap nut length	Tool length	Overall tool length	Gauge head diameter	Thimble diameter	Shank size (Morse taper)
	W	M	L	TL	D1	D2	MT
GT-102	9	8	202	277	39	38	2
GT-122	11	9.5	205	280	39	38	2
GT-162	13	11.5	212	287	49	38	2
GT-193	13	13.5	252	346	54	48	3
GT-303	15	17	312	406	69	57	3
GT-504	19	22	423	540	88	74	4

### Use of the grooving tool



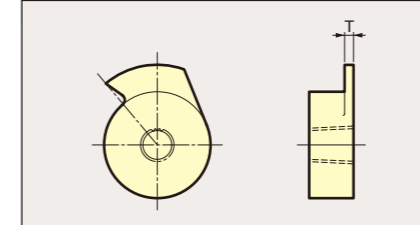
## Standard cutter

Two standard types of cutters are available, single bit and double bit.  
Please make a selection based on the following size table.

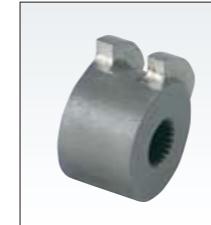
### Single bit



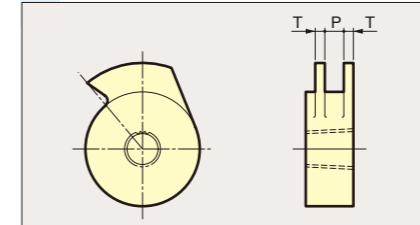
### Drawing of



### Double bit



### Drawing of



GT-193 model, machining image

### Size table (mm)

Tool No.	Cutter type	Applicable hole diameter Min.~Max.	Maximum groove depth		Type of blade	
			For Min. H.D' s	For Max. H.D' s	Single bit T	Double bit T+P+T
GT-102	H.D10 ~11	10 ~11	0.8	0.4	3	3+3+3
	H.D11 ~12	11 ~12				
	H.D12 ~13	12 ~13				
	H.D13 ~14	13 ~14				
GT-122	H.D12.7~14	12.7~14	1.3	0.8	3	3+5+3 3+6+3
	H.D14 ~15	14 ~15				
	H.D15 ~16	15 ~16				
	H.D16 ~17	16 ~17				
GT-162	H.D16 ~17	16 ~17	1.3	0.8	3	3+5+3 3+6+3
	H.D17 ~18	17 ~18				
	H.D18 ~19	18 ~19				
	H.D19 ~20	19 ~20				
GT-193	H.D20 ~21	20 ~21	2.3	1.3	3, 4	3+6+3 4+6+4
	H.D19 ~20	19 ~20				
	H.D20 ~22	20 ~22				
	H.D22 ~24	22 ~24				
	H.D24 ~26	24 ~26				
	H.D26 ~28	26 ~28				
GT-303	H.D28 ~30	28 ~30	3.7	1.8	3, 4, 5	3+6+3 4+6+4
	H.D30 ~32	30 ~32				
	H.D30 ~34	30 ~34				
	H.D34 ~38	34 ~38				
	H.D38 ~42	38 ~42				
	H.D42 ~46	42 ~46				
GT-504	H.D46 ~50	46 ~50	6.2	2.3	3, 4, 5	3+6+3 4+6+4
	H.D50 ~54	50 ~54				
	H.D50 ~58	50 ~58				
	H.D58 ~66	58 ~66				

Notes 1. Groove depth may change with the applicable hole diameter. A cutter that matches the hole diameter is needed to obtain a groove depth when the applicable hole diameter is at a minimum.  
2. Special cutters (triangular, round, trapezoidal, etc.) or dimensions (T+P+T and applicable hole diameter) other than standard ones are available to meet your request.

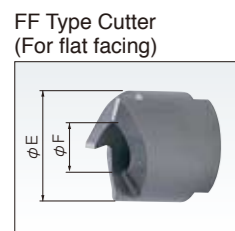
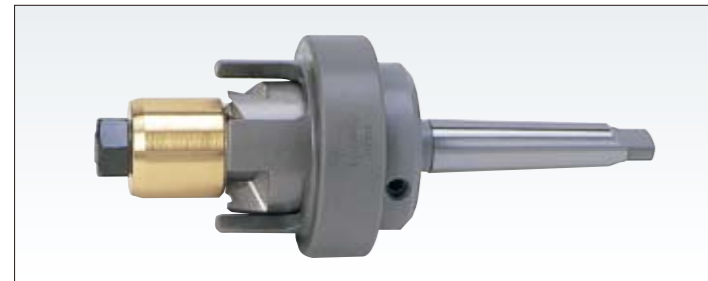
## Guide bushing

This component insert the cutter into the hole of tube sheet and hold the tool main body. Please specify the exact hole diameter when ordering.

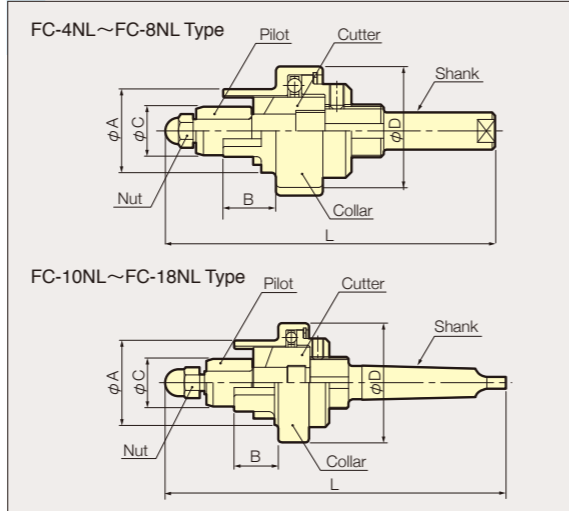


### Facing Tool

Facing tool is a tube end facing tool to make the tube projection the same length. The thread of Collar and Shank was changed to left-hand thread. Even if the set screw of Collar was loosened, this tool will not cut too much. Due to different shapes of tube end, we offer two types of cutters; one for flat facing, and the other for round facing.



#### Dimensional Drawing



Size table (mm)

Facing Tool number	Tube size			Cutter type		D	L	A	B	Pilot		Shank	Tube Projection		
	Tube O.D.	Thickness	B.W.G.	FF Type (φE×φF)	RF Type					Tool No.	C		Min.	Max.	
FC- 4NL	12.7	1.6	16	FF- 4 (17×7)	RF- 416	FC- 416P	9.3	φ 9.5	0	10	φ 9.5	0	10		
		1.5	17		RF- 417									FC- 417P	9.7
		1.2	18		RF- 418									FC- 418P	10.1
FC- 5NL	15.9	1.8	15	FF- 5 (19.5×7)	RF- 515	FC- 515P	12.1	φ 12.7	0	10	φ 12.7	0	10		
		1.6	16		RF- 516									FC- 516P	12.5
		1.5	17		RF- 517									FC- 517P	12.8
		1.2	18		RF- 518									FC- 518P	13.3
		2.4	13		RF- 613									FC- 613P	14.1
		2.1	14		RF- 614									FC- 614P	14.7
FC- 6NL	19.0	1.8	15	FF- 6 (23×11.5)	RF- 615	FC- 615P	15.3	φ 12.7	0	10	φ 12.7	0	10		
		1.6	16		RF- 616									FC- 616P	15.6
		1.5	17		RF- 617									FC- 617P	16.0
		1.2	18		RF- 618									FC- 618P	16.5
		2.1	14		RF- 714									FC- 714P	17.9
		1.8	15		RF- 715									FC- 715P	18.5
FC- 7NL	22.2	1.6	16	FF- 7 (27×11.5)	RF- 716	FC- 716P	18.8	φ 12.7	0	9	φ 12.7	0	9		
		1.5	17		RF- 717									FC- 717P	19.2
		1.2	18		RF- 718									FC- 718P	19.6
		3.4	10		RF- 810									FC- 810P	18.5
		3.0	11		RF- 811									FC- 811P	19.2
		2.8	12		RF- 812									FC- 812P	19.8
FC- 8NL	25.4	2.4	13	FF- 8 (32×16)	RF- 813	FC- 813P	20.5	φ 12.7	0	9	φ 12.7	0	9		
		2.1	14		RF- 814									FC- 814P	21.1
		1.8	15		RF- 815									FC- 815P	21.6
		1.6	16		RF- 816									FC- 816P	22.0
		1.5	17		RF- 817									FC- 817P	22.4
		1.2	18		RF- 818									FC- 818P	22.8
		3.4	10		RF-1010									FC-1010P	24.8
		3.0	11		RF-1011									FC-1011P	25.6
		2.8	12		RF-1012									FC-1012P	26.1
FC-10NL	31.8	2.4	13	FF-10 (37×16)	RF-1013	FC-1013P	26.8	MT2	0	9	MT2	0	9		
		2.1	14		RF-1014									FC-1014P	27.4
		3.4	10		RF-1210									FC-1210P	31.2
		3.0	11		RF-1211									FC-1211P	31.9
FC-12NL	38.1	2.8	12	FF-12 (42×21.5)	RF-1212	FC-1212P	32.5	MT2	0	11	MT2	0	11		
		3.4	10		RF-1410									FC-1410P	37.5
		3.0	11		RF-1411									FC-1411P	38.3
FC-14NL	44.5	2.8	12	FF-14 (51×21.5)	RF-1412	FC-1412P	38.8	MT3	0	11	MT3	0	11		
		4.2	8		RF-1608									FC-1608P	42.3
		3.8	9		RF-1609									FC-1609P	43.2
FC-16NL	50.8	3.4	10	FF-16 (57×29)	RF-1610	FC-1610P	43.9	MT3	0	11	MT3	0	11		
		4.2	8		RF-1808									FC-1808P	48.7
		3.8	9		RF-1809									FC-1809P	49.5
FC-18NL	57.1	3.4	10	FF-18 (65×29)	RF-1810	FC-1810P	50.2	MT3	0	11	MT3	0	11		

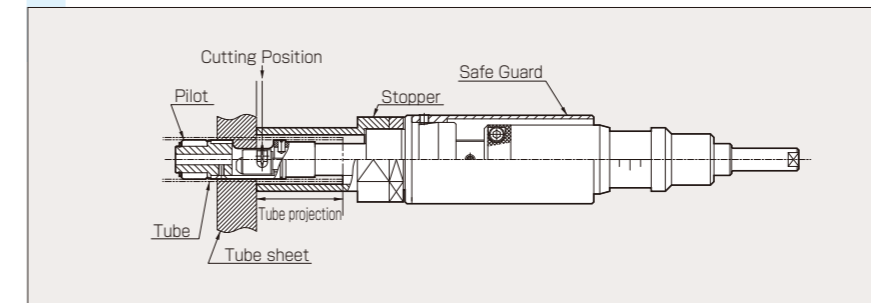
Note: Please use a driving unit such as an electric drill sold on the market.

### Rolling Tube Cutter for cutting tube projection

Cut off tube projection without generating cutting chips.



#### Dimensions

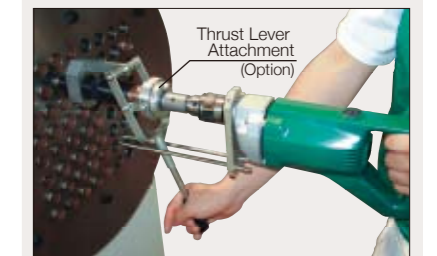


Suitable Tube Size	
O.D.	φ22~φ33
Thickness	t0.5~t2.1

Note: Please use a driving unit such as an electric drill sold on the market.

#### Thrust Lever Attachment (Option)

Attaches to driving unit. Leverage increases thrust and reduces the operator burden.



Note: Please state the name of the manufacturer and the product number of the driving unit when ordering.

#### Cutting Conditions

Please refer to the cutting conditions in the chart below according to the tube and tube sheet materials when using Facing Tool, Grooving Tool and Rolling tube cutter for tube projection cutting.

Speed of feeding, cutting and rotating		Tube/Tube Sheet Material			
		Stainless Steel Titanium	Hard Steel	Mild Steel	Copper Alloy Aluminum
Feeding (mm/rev)	Facing Tool	0.05	0.05	0.1	0.15
	Grooving Tool				
	Special Rolling Tube Cutter for Tube Projection Cutting	0.2	0.2	0.2	0.3
Cutting Speed (m/min)		10	15	20	40
Tube O.D./ Tube Sheet H.D (mm)		Rotation Speed (min <sup>-1</sup> )			
13		200~300	300~400	450~550	900~1000
16		150~250	250~350	350~450	750~850
19		100~200	200~300	300~400	600~700
22		100~200	150~250	250~350	550~650
25		100~150	250~350	200~300	450~550
32		80~120	100~200	150~250	350~450
38		60~120	100~150	100~200	300~400

- The rotation speed of Tube O.D and Tube Sheet H.D is calculated by the cutting speed.
- The cutting speed and the rotation speed are same as the Grooving Tool, Facing Tool and Rolling Tube Cutter for tube projection cutting.
- When using an electric drill or an air drill as a driving unit for the Facing Tool and/or Rolling Tube Cutter, please use a unit with an adjustable rotation speed function.

### Power Facer

This is an air-driven type of tube-face cutting tool to finish the faces of tubes for heat exchangers and condensers into various shapes. The Power Facer is safe, no reaction force, and less strain during the work.



**Applicable tube materials**

- Copper
- Stainless steel
- Copper alloy
- Aluminum alloy
- Titanium alloy
- etc.

**Examples of tube face processing**

- Flat face cutting
- Round face cutting
- I.D. chamfering
- O.D. chamfering
- Welding removal
- etc.

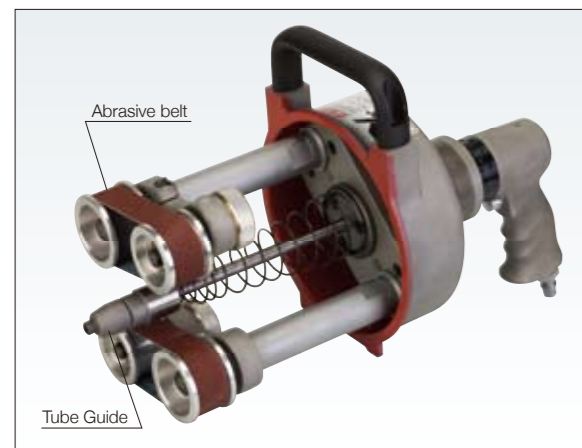


**Specification Chart (mm)**

Tool No.	Tube size		Speed (no load) min <sup>-1</sup>	Torque N·m	Cutting stroke mm	Thrust N	Operating pressure MPa	Air consumption L/min(ANR)	Weight kg
	Tube I.D. mm	Tube O.D. mm							
PF-38AP	12~36	16~38	130	Max.45	Max.30	450	0.5 <sup>+0.2</sup> <sub>-0.1</sub>	400	9
PF-38MP									5

### Tube Polisher

The external surface of a tube in a tube expansion portion must be polished to obtain a pressure joint with tube expansion. The tube polisher efficiently polishes the external surface of a tube uniformly by fixing the tube in place by auto-rotating an abrasive belt around the tube using a high-performance air motor.



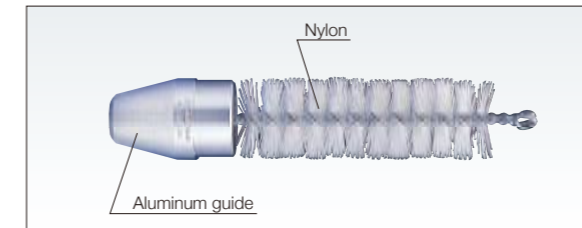
**Specification Chart**

Tool No.	TP-2050A Type	
Tube O.D. to be polished	mm	φ 16~φ 63.5
Tube length to be polished	mm	Max.140
Abrasive belt dimensions	mm	Width 25 x Total length 305
Motor speed	min <sup>-1</sup>	700
Abrasive belt speed	m/sec	4.7
Operating air pressure	MPa	0.5
Air consumption	L/min(ANR)	600
Weight	kg	7

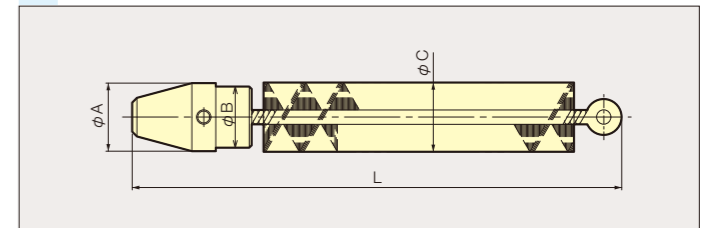
Note: Please inform us of the tube specifications (Tube O.D. x thickness and material) when ordering.

### Tube Guide

This is a guide for smooth insertion of tubes into tube sheets and baffle plates.



**Dimensional Drawing**



**Size table (mm)**

Tool No.	Tube size			A	B	C	L
	Tube O.D.	Thickness	B.W.G.				
1	25.4	1.1	19	25.4	23.0	24.3	205
2		1.2	18		22.7	23.9	
3		1.5	17		22.2	23.5	
4		1.6	16		21.9	23.1	
5	22.2	1.1	19	22.2	19.8	21.1	205
6		1.2	18		19.5	20.7	
7		1.5	17		19.0	20.3	
8		1.6	16		18.7	19.9	
9	19.0	1.1	19	19.0	16.7	17.9	205
10		1.2	18		16.3	17.6	
11		1.5	17		15.9	17.1	
12		1.6	16		15.5	16.8	
13	15.9	1.1	19	15.9	13.5	14.7	200
14		1.2	18		13.1	14.4	
15		1.5	17		12.7	13.9	
16		1.6	16		12.3	13.6	
17		1.8	15		12.0	13.2	

### Flaring Tool

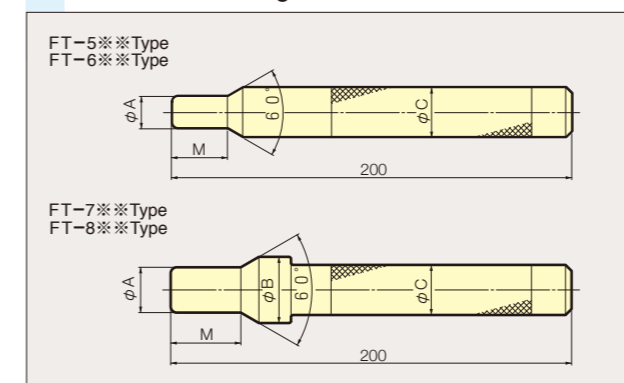
This tool is to form the ends of an expanded tube to flare angle 60° and fix them to the tube sheet.



**Size table (mm)**

Tool No.	Tube size			A	B	C	M
	Tube O.D.	Thickness	B.W.G.				
FT-515	15.9	1.8	15	11.9	-	22	25
FT-516		1.6	16	12.3			
FT-517		1.5	17	12.6			
FT-518		1.2	18	13.1			
FT-519		1.1	19	13.4			
FT-616	19.0	1.6	16	15.4	-	25	28
FT-617		1.5	17	15.8			
FT-618		1.2	18	16.2			
FT-619		1.1	19	16.6			
FT-716	22.2	1.6	16	18.6	-	29	25
FT-717		1.5	17	19.0			
FT-718		1.2	18	19.4			
FT-719		1.1	19	19.8			
FT-816	25.4	1.6	16	21.8	-	33	25
FT-817		1.5	17	22.1			
FT-818		1.2	18	22.6			
FT-819		1.1	19	23.0			

**Dimensional Drawing**

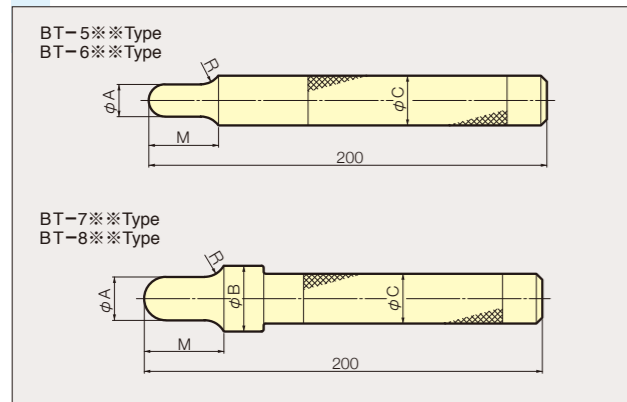


### Beading Tool

This tool is to form the ends of an expanded tube into flare radius (R) shape.



#### Dimensional Drawing



Size table (mm)

Tool No.	Tube size			A	B	C	M	R
	Tube O.D.	Thickness	B.W.G.					
BT-515	15.9	1.8	15	11.9	-	22	30	11.5
BT-516		1.6	16	12.3				11.0
BT-517		1.5	17	12.6				11.0
BT-518		1.2	18	13.1				11.0
BT-519		1.1	19	13.4				10.5
BT-616	19.0	1.6	16	15.4	-	25	35	11.0
BT-617		1.5	17	15.8				11.0
BT-618		1.2	18	16.2				11.0
BT-619		1.1	19	16.6				10.5
BT-716	22.2	1.6	16	18.6	29	25	35	11.0
BT-717		1.5	17	19.0				11.0
BT-718		1.2	18	19.4				11.0
BT-719		1.1	19	19.8				10.5
BT-816	25.4	1.6	16	21.8	33	25	40	11.0
BT-817		1.5	17	22.1				11.0
BT-818		1.2	18	22.6				11.0
BT-819		1.1	19	23.0				10.5

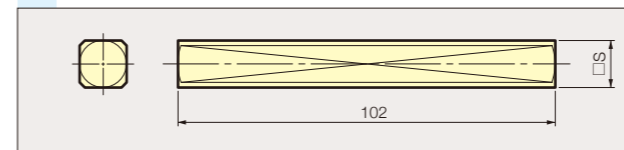


### Drive Shaft

This tool is used in tube expansion work inside boiler headers and superheaters. Used in combination with a gear block.



#### Dimensional Drawing



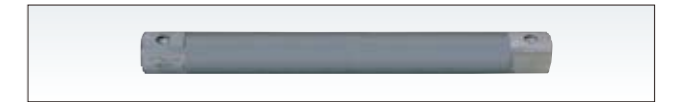
Size table (mm)

Tool No.	□ S
SD-34	9.5
SD-44	12.7
SD-64	19.0
SD-84	25.4

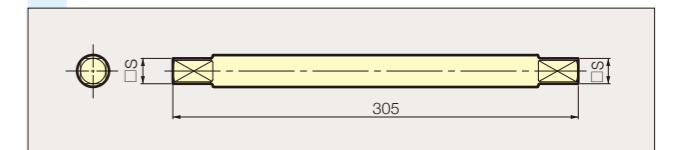
Note: For details on use, please refer to page the diagram below.

### Extension Bar

This tool is for rotational transfer. Used in combination with a universal joint or mandrel coupling.



#### Dimensional Drawing



Size table (mm)

Tool No.	□ S
EB-312	9.5
EB-412	12.7
EB-612	19.0
EB-812	25.4

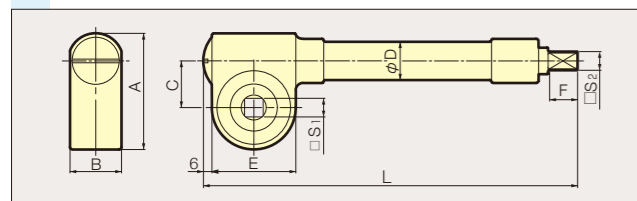
### Right Angle Drive

This is a manual tube expansion tool used when workspace is limited for boiler headers and superheaters. It allows rotational transmit at a right angle.

Worm gear RW Type (Speed ratio 1/3.75)



#### Dimensional Drawing



Size table (mm)

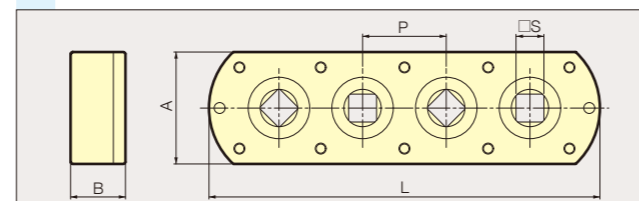
Tool No.	□S1	□S2	A	B	C	D	E	F	L
RW-44	12.7	12.7	79	35	32	25	57	19	254
RW-64	19.0								
RW-66	19.0	19.0	98	45	40	38	70	32	292
RW-86	25.4								
RW-88	25.4		130	60	54	48	89	32	330

### Gear Block

This tool is used in tube expansion work inside boiler headers and superheaters. It allows rotational transmit at a right angle by combination with a drive shaft.



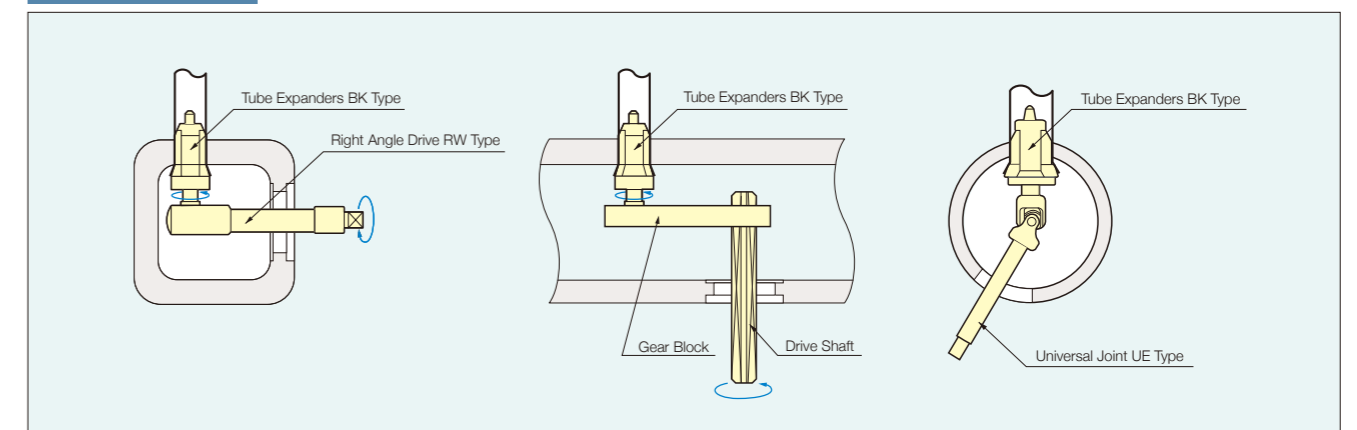
#### Dimensional Drawing



Size table (mm)

Tool No.	□ S	A	B	P	L
BG-47	12.7	51	25	38	178
BG-68	19.0	70	33	51	235
BG-89					

#### For Use

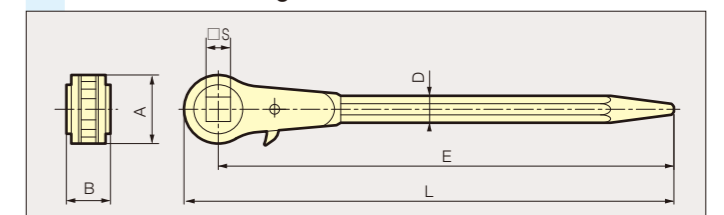


### Ratchet Handle

This is a manual tube expansion tool. It allows rotational transmit by a ratchet mechanism.



#### Dimensional Drawing



Size table (mm)

Tool No.	□ S	A	B	D	E	L
ASH 9	9.5	28	18	11	186	200
ASH13	12.7	36	20	13	227	245
ASH19	19.0	49	28	19	360	385
ASH25	25.4	67	32	22	467	500

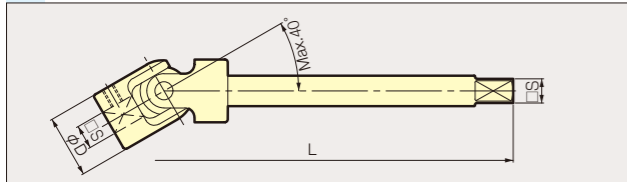
### Universal Joint

This tool transfers rotation at an angle in a maximum range of up to 40° when there are restrictions for workspace and the tube expansion drive mechanism interferes with the surroundings. 3 types are available for different applications.

#### UE Type



#### Dimensional Drawing



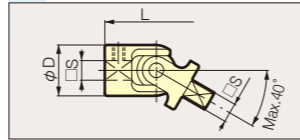
#### Size table (mm)

Tool No.	□S	L	D
UE-312	9.5	305	33
UE-416	12.7	406	33
UE-620	19.0	508	54
UE-820	25.4		

#### UC Type



#### Dimensional Drawing



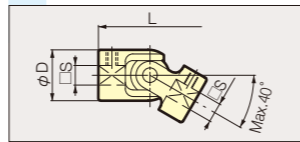
#### Size table (mm)

Tool No.	□S	L	D
UC-33	9.5	74	33
UC-44	12.7		
UC-66	19.0	118	54
UC-88	25.4		

#### UJ Type



#### Dimensional Drawing



#### Size table (mm)

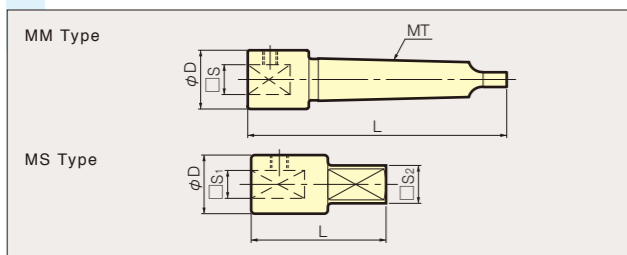
Tool No.	□S	L	D
UJ-33	9.5	67	33
UJ-44	12.7		
UJ-66	19.0	106	54
UJ-88	25.4		

### Mandrel Driver

These are attachment accessories for a main shaft of the driving unit. 2 types are available, a Morse taper and a square shank.



#### Dimensional Drawing



#### Size table (mm)

● MM Type

Tool No.	D	L	□S	MT
MM-33	20	125	9.5	3
MM-44	25	150	12.7	4
MM-65	37	200	19.0	5
MM-85	45	200	25.4	5

● MS Type

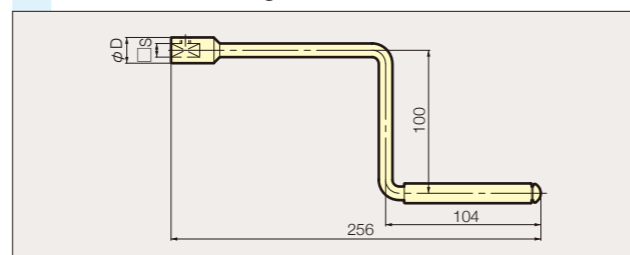
Tool No.	D	L	□S <sub>1</sub>	□S <sub>2</sub>
MS-34	20	45	9.5	12.7
MS-36	25	58	9.5	19.0
MS-46	25	59	12.7	19.0
MS-48	32	59	12.7	25.4
MS-68	35	72	19.0	25.4

### S Handle

An easy handle for tube expander rotational drive.



#### Dimensional Drawing



#### Size table (mm)

Tool No.	D	□S
□6.3	14	6.3
□9.5	18	9.5
□12.7	25	12.7

### Easy selection charts for Tube Expanders

The easy selection chart for the typical tube sizes is listed in the following charts. For tube sizes that are not listed, please select an expander using the formula for calculation on this page.

#### How to select the correct expander

Select model numbers of tube expanders from the Dimensional Specifications Chart based on the value calculated in the formula shown below.

- 1) For minimum diameter (D min.)  
 $D_{min.} = D - \delta D - 2t(1 + \delta t/100) - \alpha$
- 2) For maximum diameter (D max.)  
 $D_{max.} = H - 2t(1 - \delta t/100) \times (1 - Wt/100) + \beta$
- D : Tube O.D. (mm)  
 $\delta D$  : Tolerance of Tube O.D. (mm)  
 t : Tube wall thickness(mm)  
 $\delta t$  : Tolerance of tube wall thickness (%)·Plus  
 $\alpha$  : Clearance for inserting tube expander into the tube (0.1~0.2mm)
- H : Tube sheet hole diameter (mm)  
 $\delta t'$  : Tolerance of tube wall thickness (%)·Minus  
 Wt : Percentage reduction of tube wall thickness (%)  
 $\beta$  : Diameter allowance for tube expander (0.2~0.5mm)

#### MB Type Easy selection chart (mm)

Type	Tube size			Tube Expansion range D				Mandrel		
				Min.	Roller length M=13		Roller length M=25			
	Tube O.D.	Thickness	B.W.G.		Max.	Expander tool number	Max.	Expander tool number	Tool No.	Shank □S
MB Type	6.4 (1/4")	0.71	22	4.6	5.6	MB-00	-	-	M-0	6.3
		0.64	23	5.0	6.0	MB-0				
		0.56	24	5.0	6.0	MB-0				
		0.51	25	5.0	6.0	MB-0				
	9.5 (3/8")	1.07	19	7.0	-	-	8.1	MB-15	M-2	6.3
		0.89	20	7.4			8.5	MB-16		
		0.81	21	7.4			8.5	MB-16		
		0.71	22	7.8			9.0	MB-17		
		0.64	23	7.8			9.0	MB-17		
		0.64	23	7.8			9.0	MB-17		
	12.7 (1/2")	1.47	17	9.0	-	-	10.2	MB-20	M-3	6.3

#### CJ Type / HJ Type Easy selection chart (mm)

Type	Tube size			Tube Expansion range D						Mandrel					
				Min.	Roller length M=38		Roller length M=57		Roller length M=76						
	Tube O.D.	Thickness	B.W.G.		Max.	Expander tool number	Max.	Expander tool number	Max.	Expander tool number	Tool No.	Shank □S			
CJ Type / HJ Type	12.7 (1/2")	1.24	18	9.2	10.9	CJ(HJ)-101	-	-	-	-	CJ 1M	HJ 1M	9.5		
		1.07	19	10.0	11.7	CJ(HJ)-103					CJ 2M	HJ 2M			
		0.89	20	10.0	11.7	CJ(HJ)-103					CJ 2M	HJ 2M			
		0.71	22	10.8	12.5	CJ(HJ)-105					CJ 2M	HJ 2M			
		0.64	23	10.8	12.5	CJ(HJ)-105					CJ 2M	HJ 2M			
		0.56	24	10.8	12.5	CJ(HJ)-105					CJ 2M	HJ 2M			
	15.9 (5/8")	1.47	17	12.4	14.3	CJ(HJ)-109	14.0	CJ(HJ)-209	-	-	CJ 4M	HJ 4M	9.5		
		1.24	18	12.4	14.3	CJ(HJ)-109	14.0	CJ(HJ)-209			CJ 4M	HJ 4M			
		1.07	19	13.2	15.1	CJ(HJ)-111	14.8	CJ(HJ)-211			CJ 4M	HJ 4M			
		0.89	20	13.2	15.1	CJ(HJ)-111	14.8	CJ(HJ)-211			CJ 4M	HJ 4M			
		0.81	21	14.0	16.2	CJ(HJ)-113	15.8	CJ(HJ)-213			CJ 6M	HJ 6M			
		0.71	22	14.0	16.2	CJ(HJ)-113	15.8	CJ(HJ)-213			CJ 6M	HJ 6M			
	19.0 (3/4")	1.65	16	14.8	17.0	CJ(HJ)-115	16.6	CJ(HJ)-215	-	-	CJ 6M	HJ 6M	9.5		
		1.47	17	14.8	17.0	CJ(HJ)-115	16.6	CJ(HJ)-215			CJ 6M	HJ 6M			
		1.24	18	15.6	17.8	CJ(HJ)-117	17.4	CJ(HJ)-217			CJ 6M	HJ 6M			
		1.07	19	15.6	17.8	CJ(HJ)-117	17.4	CJ(HJ)-217			CJ 6M	HJ 6M			
		0.89	20	16.4	18.9	CJ(HJ)-119	18.4	CJ(HJ)-219			18.0	CJ(HJ)-319		CJ 8M	HJ 8M
		0.81	21	16.4	18.9	CJ(HJ)-119	18.4	CJ(HJ)-219			-	-		CJ 8M	HJ 8M
	22.2 (7/8")	2.41	13	16.4	18.9	CJ(HJ)-119	18.4	CJ(HJ)-219	-	-	CJ 8M	HJ 8M	9.5		
		2.11	14	17.1	19.7	CJ(HJ)-121	19.2	CJ(HJ)-221			CJ 8M	HJ 8M			
		1.83	15	17.1	19.7	CJ(HJ)-121	-	-			CJ 8M	HJ 8M			
		1.65	16	17.9	20.5	CJ(HJ)-123	20.0	CJ(HJ)-223			CJ 8M	HJ 8M			
		1.47	17	17.9	20.5	CJ(HJ)-123	20.0	CJ(HJ)-223			CJ 8M	HJ 8M			
		1.24	18	18.7	21.5	CJ(HJ)-125	21.1	CJ(HJ)-225			20.6	CJ(HJ)-325		CJ10M	HJ10M
1.07		19	19.5	22.3	CJ(HJ)-127	21.9	CJ(HJ)-227	21.4			CJ(HJ)-327	CJ10M		HJ10M	
0.89		20	19.5	22.3	CJ(HJ)-127	21.9	CJ(HJ)-227	21.4			CJ(HJ)-327	CJ10M		HJ10M	



CJ Type·CB Type / HJ Type·HB Type Easy selection chart (mm)

Type	Tube size			Tube Expansion range D						Mandrel				
	Tube O.D.	Thickness	B.W.G.	Min.	Roller length M=38		Roller length M=57		Roller length M=76		Tool No.		Shank □S	
					Max.	Expander tool number	Max.	Expander tool number	Max.	Expander tool number	CJ·CB	HJ·HB		
CJ Type/ HJ Type	25.4 (1")	2.77	12	18.7	21.5	CJ(HJ)-125	21.1	CJ(HJ)-225	—	—	CJ10M	HJ10M	9.5	
		2.41	13	19.5	22.3	CJ(HJ)-127	21.9	CJ(HJ)-227	—	—	CJ10M	HJ10M		
		2.11	14	20.3	23.1	CJ(HJ)-129	22.6	CJ(HJ)-229	—	—	CJ10M	HJ10M		
		1.83	15	20.3	23.1	CJ(HJ)-129	22.6	CJ(HJ)-229	—	—	CJ10M	HJ10M		
		1.65	16	21.1	23.9	CJ(HJ)-131	23.4	CJ(HJ)-231	—	—	CJ10M	HJ10M		
		1.47	17	21.5	25.0	CJ(HJ)-132	24.4	CJ(HJ)-232	23.8	CJ(HJ)-332	CJ11M	HJ11M		
	31.8 (1-1/4")	1.24	18	22.3	25.8	CJ(HJ)-134	25.2	CJ(HJ)-234	24.6	CJ(HJ)-334	CJ11M	HJ11M	12.7	
		1.07	19	22.3	25.8	CJ(HJ)-134	25.2	CJ(HJ)-234	24.6	CJ(HJ)-334	CJ11M	HJ11M		
		3.40	10	23.1	26.5	CJ(HJ)-136	—	—	—	—	CJ11M	HJ11M		
		3.05	11	23.9	27.3	CJ(HJ)-138	—	—	—	—	CJ11M	HJ11M		
CB Type/ HB Type	31.8 (1-1/4")	2.41	13	25.5	29.5	CB(HB)-142	28.8	CB(HB)-242	28.2	CB(HB)-342	C-12	H-12	12.7	
		2.11	14	26.3	30.3	CB(HB)-144	29.6	CB(HB)-244	29.0	CB(HB)-344	C-12	H-12		
		1.83	15	27.1	31.1	CB(HB)-146	30.4	CB(HB)-246	29.8	CB(HB)-346	C-12	H-12		
		1.65	16	27.1	31.1	CB(HB)-146	30.4	CB(HB)-246	29.8	CB(HB)-346	C-12	H-12		
		1.47	17	27.9	31.9	CB(HB)-148	31.2	CB(HB)-248	30.6	CB(HB)-348	C-12	H-12		
	38.1 (1-1/2")	1.24	18	27.9	31.9	CB(HB)-148	31.2	CB(HB)-248	30.6	CB(HB)-348	C-12	H-12	12.7	
		4.19	8	27.9	31.9	CB(HB)-148	31.2	CB(HB)-248	—	—	C-12	H-12		
		3.76	9	28.7	32.7	CB(HB)-150	32.0	CB(HB)-250	—	—	C-12	H-12		
		3.40	10	29.5	34.1	CB(HB)-152	33.0	CB(HB)-252	—	—	C-13	H-13		
		3.05	11	30.3	34.9	CB(HB)-154	34.1	CB(HB)-254	33.4	CB(HB)-354	C-13	H-13		
2.77		12	31.1	35.7	CB(HB)-156	34.9	CB(HB)-256	34.2	CB(HB)-356	C-13	H-13			
2.41		13	31.9	36.5	CB(HB)-158	35.7	CB(HB)-258	35.0	CB(HB)-358	C-13	H-13			
2.11		14	32.6	37.2	CB(HB)-160	36.5	CB(HB)-260	35.7	CB(HB)-360	C-13	H-13			
1.83		15	33.4	38.0	CB(HB)-162	37.3	CB(HB)-262	36.5	CB(HB)-362	C-13	H-13			
1.65		16	33.4	38.0	CB(HB)-162	37.3	CB(HB)-262	36.5	CB(HB)-362	C-13	H-13			
44.5 (1-3/4")	4.19	8	33.4	38.0	CB(HB)-162	—	—	—	—	C-13	H-13	19.0		
	3.76	9	35.1	—	—	39.7	CB(HB)-264	38.9	CB(HB)-364	C-14	H-14			
	3.40	10	35.1	—	—	39.7	CB(HB)-264	38.9	CB(HB)-364	C-14	H-14			
	3.05	11	36.6	—	—	41.3	CB(HB)-266	40.5	CB(HB)-366	C-14	H-14			
	2.77	12	36.6	—	—	41.3	CB(HB)-266	40.5	CB(HB)-366	C-14	H-14			
	2.41	13	38.2	—	—	42.9	CB(HB)-268	42.1	CB(HB)-368	C-14	H-14			
	2.11	14	38.2	—	—	42.9	CB(HB)-268	42.1	CB(HB)-368	C-14	H-14			
	1.83	15	38.2	—	—	42.9	CB(HB)-268	42.1	CB(HB)-368	C-14	H-14			
	50.8 (2")	3.76	9	40.7	—	—	46.1	CB(HB)-270	45.3	CB(HB)-370	C-15		H-15	19.0
		3.40	10	40.7	—	—	46.1	CB(HB)-270	45.3	CB(HB)-370	C-15		H-15	
3.05		11	40.7	—	—	46.1	CB(HB)-270	—	—	C-15	H-15			
2.77		12	43.9	—	—	49.2	CB(HB)-272	48.4	CB(HB)-372	C-15	H-15			
2.41		13	43.9	—	—	49.2	CB(HB)-272	48.4	CB(HB)-372	C-15	H-15			
2.11		14	43.9	—	—	49.2	CB(HB)-272	48.4	CB(HB)-372	C-15	H-15			
57.2 (2-1/4")		5.16	6	43.9	—	—	49.2	CB(HB)-272	—	—	C-15	H-15	19.0	
		3.76	9	47.0	—	—	52.4	CB(HB)-274	51.6	CB(HB)-374	C-15	H-15		
		3.05	11	49.5	—	—	55.6	CB(HB)-276	54.8	CB(HB)-376	C-16	H-16		
		2.77	12	49.5	—	—	55.6	CB(HB)-276	54.8	CB(HB)-376	C-16	H-16		
	2.41	13	49.5	—	—	55.6	CB(HB)-276	54.8	CB(HB)-376	C-16	H-16			
	2.11	14	49.5	—	—	55.6	CB(HB)-276	54.8	CB(HB)-376	C-16	H-16			
	63.5 (2-1/2")	5.59	5	49.5	—	—	55.6	CB(HB)-276	54.8	CB(HB)-376	C-16	H-16		19.0
		5.16	6	49.5	—	—	55.6	CB(HB)-276	—	—	C-16	H-16		
		4.19	8	52.7	—	—	58.8	CB(HB)-278	58.0	CB(HB)-378	C-16	H-16		
		3.76	9	52.7	—	—	58.8	CB(HB)-278	58.0	CB(HB)-378	C-16	H-16		
3.40		10	52.7	—	—	58.8	CB(HB)-278	—	—	C-16	H-16			
3.05		11	55.9	—	—	61.9	CB(HB)-280	61.1	CB(HB)-380	C-16	H-16			
2.77		12	55.9	—	—	61.9	CB(HB)-280	61.1	CB(HB)-380	C-16	H-16			
76.2 (3")		7.21	2	58.2	—	—	65.1	CB(HB)-282	64.3	CB(HB)-382	C-17	H-17	19.0	
		5.59	5	61.4	—	—	68.3	CB(HB)-284	67.5	CB(HB)-384	C-17	H-17		
		5.16	6	61.4	—	—	68.3	CB(HB)-284	—	—	C-17	H-17		
	4.57	7	64.6	—	—	71.5	CB(HB)-286	70.7	CB(HB)-386	C-17	H-17			
	4.19	8	64.6	—	—	71.5	CB(HB)-286	70.7	CB(HB)-386	C-17	H-17			
	3.76	9	64.6	—	—	71.5	CB(HB)-286	70.7	CB(HB)-386	C-17	H-17			
	3.40	10	67.1	—	—	75.4	CB(HB)-288	74.5	CB(HB)-388	C-18	H-18			
	3.05	11	67.1	—	—	75.4	CB(HB)-288	74.5	CB(HB)-388	C-18	H-18			
	BK Type	38.1 (1-1/2")	4.2	8	19.0	BK-371	27.8	32.2	DM- 2S	HM- 2S	—			
					25.4	BK-372	27.8	32.0			—			
32.0					BK-373	27.8	31.7	—						
38.0					BK-374	27.8	31.5	—						
44.5					BK-375	27.8	31.3	—						
51.0					BK-376	27.8	31.1	—						
38.1 (1-1/2")		3.8	9	19.0	BK-381	28.6	33.0	DM- 2S	HM- 2S	—				
				25.4	BK-382	28.6	32.8			—				
				32.0	BK-383	28.6	32.5			—				
				38.0	BK-384	28.6	32.3			—				
	44.5			BK-385	28.6	32.1	—							
	51.0			BK-386	28.6	31.9	—							
38.1 (1-1/2")	3.4	10	19.0	BK-391	29.4	34.4	DM- 3	HM- 3	S-3~6					
			25.4	BK-392	29.4	34.2			S-3~6					
			32.0	BK-393	29.4	33.9			S-3~6					
			38.0	BK-394	29.4	33.7			S-3~6					
			44.5	BK-395	29.4	33.5			—					
			51.0	BK-396	29.4	33.3			—					
38.1 (1-1/2")	3.0	11	19.0	BK-401	30.2	35.2	DM- 3	HM- 3	S-3~6					
			25.4	BK-402	30.2	35.0			S-3~6					
			32.0	BK-403	30.2	34.7			S-3~6					
			38.0	BK-404	30.2	34.5			S-3~6					
			44.5	BK-405	30.2	34.3			—					
			51.0	BK-406	30.2	34.1			—					
38.1 (1-1/2")	2.8	12	19.0	BK-411	31.0	36.0	DM- 3	HM- 3	S-3~6					
			25.4	BK-412	31.0	35.8			S-3~6					
			32.0	BK-413	31.0	35.5			S-3~6					
			38.0	BK-414	31.0	35.3			S-3~6					
			44.5	BK-415	31.0	35.1			—					
			51.0	BK-416	31.0	34.9			—					
38.1 (1-1/2")	2.4	13	19.0	BK-421	31.8	36.8	DM- 3	HM- 3	S-3~6					
			25.4	BK-422	31.8	36.6			S-3~6					
			32.0	BK-423	31.8	36.3			S-3~6					
			38.0	BK-424	31.8	36.1			S-3~6					
			44.5	BK-425	31.8	35.9			—					
			51.0	BK-426	31.8	35.7			—					
38.1 (1-1/2")	2.1	14	19.0	BK-431	32.5	37.5	DM- 3	HM- 3	S-3~6					
			25.4	BK-432	32.5	37.3			S-3~6					
			32.0	BK-433	32.5	37.1			S-3~6					
			38.0	BK-434	32.5	36.9			S-3~6					
			44.5	BK-435	32.5	36.7			—					
			51.0	BK-436	32.5	36.5			—					
38.1 (1-1/2")	1.6~1.8	15, 16	19.0	BK-441	33.3	38.3	DM- 3	HM- 3	S-3~6					
			25.4	BK-442	33.3	38.1			S-3~6					
			32.0	BK-443	33.3	37.9			S-3~6					
			38.0	BK-444	33.3	37.7			S-3~6					
			44.5	BK-445	33.3	37.5			—					
			51.0	BK-446	33.3	37.3			—					
50.8 (2")	4.6~5.2	6, 7	19.0	BK-501	38.1	45.6	DM-11	HM-11	SM-11~13					
			25.4	BK-502	38.1	45.4			SM-11~13					
			32.0	BK-503	38.1	45.2			SM-11~13					
			38.0	BK-504	38.1	45.0			SM-11~13					
			44.5	BK-505	38.1	44.8			—					
			51.0	BK-506	38.1	44.6			—					
50.8 (2")	3.8~4.2	8, 9	19.0	BK-511	39.7	47.2	DM-11	HM-11	SM-11~13					
			25.4	BK-512	39.7	47.0			SM-11~13					
			32.0	BK-513	39.7	46.8			SM-11~13					
			38.0	BK-514	39.7	46.6			SM-11~13					

BK Type Easy selection chart (mm)

Easy selection chart for Tube Expanders

Easy selection chart for Tube Expanders

BK Type Easy selection chart (mm)

Type	Tube size			Tube sheet thickness	Expander tool number	Tube Expansion range D		Mandrel number		
	Tube O.D.	Thickness	B.W.G.			Min.	Max.	Drum mandrel	Header mandrel	Short mandrel
BK Type	50.8 (2")	3.8~4.2	8, 9	44.5	BK-515	39.7	46.4	DM-11	HM-11	—
				51.0	BK-516	39.7	46.2			—
				57.0	BK-517	39.7	45.9			—
				63.5	BK-518	39.7	45.7			—
	50.8 (2")	3.0~3.4	10, 11	19.0	BK-521	41.3	48.8	DM-11	HM-11	SM-11~13
				25.4	BK-522	41.3	48.6			SM-11~13
				32.0	BK-523	41.3	48.4			SM-11~13
				38.0	BK-524	41.3	48.2			SM-11~13
				44.5	BK-525	41.3	47.9			—
				51.0	BK-526	41.3	47.7			—
				57.0	BK-527	41.3	47.5			—
				63.5	BK-528	41.3	47.3			—
	50.8 (2")	2.4~2.8	12, 13	19.0	BK-531	42.9	50.4	DM-11	HM-11	SM-11~13
				25.4	BK-532	42.9	50.2			SM-11~13
				32.0	BK-533	42.9	50.0			SM-11~13
				38.0	BK-534	42.9	49.8			SM-11~13
				44.5	BK-535	42.9	49.5			—
				51.0	BK-536	42.9	49.3			—
	50.8 (2")	2.1	14	19.0	BK-541	44.5	52.0	DM-12	HM-12	SM-12~14
				25.4	BK-542	44.5	51.8			SM-12~14
				32.0	BK-543	44.5	51.6			SM-12~14
				38.0	BK-544	44.5	51.4			SM-12~14
				44.5	BK-545	44.5	51.1			—
				51.0	BK-546	44.5	50.9			—
	63.5 (2-1/2")	6.6	3	19.0	BK-551	46.0	53.6	DM-12	HM-12	SM-12~14
				25.4	BK-552	46.0	53.4			SM-12~14
				32.0	BK-553	46.0	53.1			SM-12~14
				38.0	BK-554	46.0	52.9			SM-12~14
				44.5	BK-555	46.0	52.7			—
	63.5 (2-1/2")	6	4	19.0	BK-561	47.6	55.1	DM-12	HM-12	SM-12~14
				25.4	BK-562	47.6	54.9			SM-12~14
				32.0	BK-563	47.6	54.7			SM-12~14
				38.0	BK-564	47.6	54.5			SM-12~14
				44.5	BK-565	47.6	54.3			—
				51.0	BK-566	47.6	54.1			—
	63.5 (2-1/2")	5.2~5.6	5, 6	19.0	BK-571	49.2	56.7	DM-12	HM-12	SM-12~14
				25.4	BK-572	49.2	56.5			SM-12~14
				32.0	BK-573	49.2	56.3			SM-12~14
				38.0	BK-574	49.2	56.1			SM-12~14
				44.5	BK-575	49.2	55.9			—
				51.0	BK-576	49.2	55.7			—
	63.5 (2-1/2")	4.6	7	19.0	BK-581	50.8	58.3	DM-13	HM-13	SM-13~15
				25.4	BK-582	50.8	58.1			SM-13~15
				32.0	BK-583	50.8	57.9			SM-13~15
				38.0	BK-584	50.8	57.7			SM-13~15
				44.5	BK-585	50.8	57.5			—
				51.0	BK-586	50.8	57.3			—
				57.0	BK-587	50.8	57.1			—
				63.5	BK-588	50.8	56.8			—
	63.5 (2-1/2")	3.8~4.2	8, 9	19.0	BK-591	52.4	59.9	DM-13	HM-13	SM-13~15
				25.4	BK-592	52.4	59.7			SM-13~15
				32.0	BK-593	52.4	59.5			SM-13~15
				38.0	BK-594	52.4	59.3			SM-13~15

BK Type Easy selection chart (mm)

Type	Tube size			Tube sheet thickness	Expander tool number	Tube Expansion range D		Mandrel number		
	Tube O.D.	Thickness	B.W.G.			Min.	Max.	Drum mandrel	Header mandrel	Short mandrel
BK Type	63.5 (2-1/2")	3.8~4.2	8, 9	44.5	BK-595	52.4	59.1	DM-13	HM-13	—
				51.0	BK-596	52.4	58.9			—
				57.0	BK-597	52.4	58.6			—
				63.5	BK-598	52.4	58.4			—
	63.5 (2-1/2")	3.0~3.4	10, 11	19.0	BK-601	54.0	61.5	DM-13	HM-13	SM-13~15
				25.4	BK-602	54.0	61.3			SM-13~15
				32.0	BK-603	54.0	61.1			SM-13~15
				38.0	BK-604	54.0	60.9			SM-13~15
				44.5	BK-605	54.0	60.6			—
				51.0	BK-606	54.0	60.4			—
				57.0	BK-607	54.0	60.2			—
				63.5	BK-608	54.0	60.0			—
	63.5 (2-1/2")	2.1	14	19.0	BK-611	55.6	63.1	DM-13	HM-13	SM-13~15
				25.4	BK-612	55.6	62.9			SM-13~15
				32.0	BK-613	55.6	62.7			SM-13~15
				38.0	BK-614	55.6	62.5			SM-13~15
				44.5	BK-615	55.6	62.2			—
				51.0	BK-616	55.6	61.0			—
	63.5 (2-1/2")	2.1	14	19.0	BK-621	57.2	66.0	DM-14	HM-14	SM-14~17
				25.4	BK-622	57.2	65.8			SM-14~17
				32.0	BK-623	57.2	65.5			SM-14~17
				38.0	BK-624	57.2	65.3			SM-14~17
				44.5	BK-625	57.2	65.1			—
				51.0	BK-626	57.2	65.8			—
	76.2 (3")	7.2~7.6	1, 2	19.0	BK-621	57.2	66.0	DM-14	HM-14	SM-14~17
				25.4	BK-622	57.2	65.8			SM-14~17
				32.0	BK-623	57.2	65.5			SM-14~17
				38.0	BK-624	57.2	65.3			SM-14~17
				44.5	BK-625	57.2	65.1			—
				51.0	BK-626	57.2	65.8			—
	76.2 (3")	6.6	3	19.0	BK-631	58.7	67.6	DM-14	HM-14	SM-14~17
				25.4	BK-632	58.7	67.4			SM-14~17
				32.0	BK-633	58.7	67.1			SM-14~17
				38.0	BK-634	58.7	66.9			SM-14~17
				44.5	BK-635	58.7	66.7			—
				51.0	BK-636	58.7	66.4			—
	76.2 (3")	6.0	4	19.0	BK-641	60.3	69.2	DM-14	HM-14	SM-14~17
				25.4	BK-642	60.3	69.0			SM-14~17
				32.0	BK-643	60.3	68.7			SM-14~17
				38.0	BK-644	60.3	68.5			SM-14~17
				44.5	BK-645	60.3	68.3			—
				51.0	BK-646	60.3	68.0			—
	76.2 (3")	5.2~5.6	5, 6	19.0	BK-651	61.9	70.8	DM-14	HM-14	SM-14~17
				25.4	BK-652	61.9	70.5			SM-14~17
				32.0	BK-653	61.9	70.3			SM-14~17
				38.0	BK-654	61.9	70.1			SM-14~17
				44.5	BK-655	61.9	69.8			—
				51.0	BK-656	61.9	69.6			—
				57.0	BK-657	61.9	69.4			—
				63.5	BK-658	61.9	69.1			—

Easy selection chart for Tube Expanders

Easy selection chart for Tube Expanders

BK Type Easy selection chart (mm)

Type	Tube size			Tube sheet thickness	Expander tool number	Tube Expansion range D		Mandrel number		
	Tube O.D.	Thickness	B.W.G.			Min.	Max.	Drum mandrel	Header mandrel	Short mandrel
BK Type	76.2 (3")	4.6	7	19.0	BK-661	63.5	72.3	DM-14	HM-14	SM-14~17
				25.4	BK-662	63.5	72.1			SM-14~17
				32.0	BK-663	63.5	71.9			SM-14~17
				38.0	BK-664	63.5	71.6			SM-14~17
				44.5	BK-665	63.5	71.4			—
				51.0	BK-666	63.5	71.2			—
				57.0	BK-667	63.5	70.9			—
				63.5	BK-668	63.5	70.7			—
	76.2 (3")	3.8~4.2	8, 9	19.0	BK-671	65.1	73.9	DM-15	HM-15	SM-15~18
				25.4	BK-672	65.1	73.7			SM-15~18
				32.0	BK-673	65.1	73.5			SM-15~18
				38.0	BK-674	65.1	73.2			SM-15~18
				44.5	BK-675	65.1	73.0			—
				51.0	BK-676	65.1	72.8			—
				57.0	BK-677	65.1	72.5			—
				63.5	BK-678	65.1	72.3			—
	76.2 (3")	3.4	10	19.0	BK-681	66.7	75.5	DM-16	HM-16	SS-16~19
				25.4	BK-682	66.7	75.3			SS-16~19
				32.0	BK-683	66.7	75.0			SS-16~19
				38.0	BK-684	66.7	74.8			SS-16~19
				44.5	BK-685	66.7	74.6			—
				51.0	BK-686	66.7	74.3			—
				57.0	BK-687	66.7	74.1			—
				63.5	BK-688	66.7	73.4			—
	76.2 (3")	2.4~2.8	12, 13	19.0	BK-691	68.3	77.1	DM-16	HM-16	SS-16~19
				25.4	BK-692	68.3	76.9			SS-16~19
				32.0	BK-693	68.3	76.6			SS-16~19
				38.0	BK-694	68.3	76.4			SS-16~19
				44.5	BK-695	68.3	76.2			—
				51.0	BK-696	68.3	75.4			—
				57.0	BK-697	68.3	75.7			—
				63.5	BK-698	68.3	75.5			—
	88.9 (3-1/2")	8.6	0	19.0	BK-681	66.7	75.5	DM-16	HM-16	SS-16~19
				25.4	BK-682	66.7	75.3			SS-16~19
				32.0	BK-683	66.7	75.0			SS-16~19
				38.0	BK-684	66.7	74.8			SS-16~19
				44.5	BK-685	66.7	74.6			—
	88.9 (3-1/2")	7.2~7.6	1, 2	19.0	BK-701	69.9	78.7	DM-16	HM-16	SS-16~19
				25.4	BK-702	69.9	78.5			SS-16~19
				32.0	BK-703	69.9	78.2			SS-16~19
				38.0	BK-704	69.9	78.0			SS-16~19
				44.5	BK-705	69.9	77.8			—
51.0				BK-706	69.9	77.5	—			
57.0				BK-707	69.9	77.3	—			
63.5				BK-708	69.9	77.0	—			
88.9 (3-1/2")	6.6	3	19.0	BK-711	71.4	80.3	DM-16	HM-16	SS-16~19	
			25.4	BK-712	71.4	80.1			SS-16~19	
			32.0	BK-713	71.4	79.8			SS-16~19	
			38.0	BK-714	71.4	79.6			SS-16~19	
			44.5	BK-715	71.4	79.4			—	
			51.0	BK-716	71.4	79.1			—	
			57.0	BK-717	71.4	78.9			—	
			63.5	BK-718	71.4	78.6			—	
88.9 (3-1/2")	5.2~5.6	5, 6	19.0	BK-721	73.0	81.9	DM-16	HM-16	SS-16~19	
			25.4	BK-722	73.0	81.6			SS-16~19	
			32.0	BK-723	73.0	81.4			SS-16~19	
			38.0	BK-724	73.0	81.2			SS-16~19	
			44.5	BK-725	73.0	80.9			—	
			51.0	BK-726	73.0	80.7			—	
			57.0	BK-727	73.0	80.5			—	
			63.5	BK-728	73.0	80.2			—	

BK Type Easy selection chart (mm)

Type	Tube size			Tube sheet thickness	Expander tool number	Tube Expansion range D		Mandrel number		
	Tube O.D.	Thickness	B.W.G.			Min.	Max.	Drum mandrel	Header mandrel	Short mandrel
BK Type	88.9 (3-1/2")	5.2~5.6	5, 6	19.0	BK-731	74.6	83.5	DM-17	HM-17	SS-17~20
				25.4	BK-732	74.6	83.2			SS-17~20
				32.0	BK-733	74.6	83.0			SS-17~20
				38.0	BK-734	74.6	82.8			SS-17~20
				44.5	BK-735	74.6	82.5			—
				51.0	BK-736	74.6	82.3			—
				57.0	BK-737	74.6	82.1			—
				63.5	BK-738	74.6	81.8			—
	88.9 (3-1/2")	4.6	7	19.0	BK-741	76.2	86.3	DM-18	HM-18	SS-18~22
				25.4	BK-742	76.2	86.1			SS-18~22
				32.0	BK-743	76.2	85.8			SS-18~22
				38.0	BK-744	76.2	85.5			SS-18~22
				44.5	BK-745	76.2	85.3			—
				51.0	BK-746	76.2	85.0			—
				57.0	BK-747	76.2	84.7			—
				63.5	BK-748	76.2	84.5			—
	88.9 (3-1/2")	3.8~4.2	8, 9	19.0	BK-751	77.8	87.9	DM-18	HM-18	SS-18~22
				25.4	BK-752	77.8	87.6			SS-18~22
				32.0	BK-753	77.8	87.4			SS-18~22
				38.0	BK-754	77.8	87.1			SS-18~22
				44.5	BK-755	77.8	86.9			—
				51.0	BK-756	77.8	86.6			—
				57.0	BK-757	77.8	86.3			—
				63.5	BK-758	77.8	86.1			—
	88.9 (3-1/2")	3.0~3.4	10, 11	19.0	BK-761	79.4	89.5	DM-18	HM-18	SS-18~22
				25.4	BK-762	79.4	89.2			SS-18~22
				32.0	BK-763	79.4	89.0			SS-18~22
				38.0	BK-764	79.4	88.7			SS-18~22
				44.5	BK-765	79.4	88.5			—
				51.0	BK-766	79.4	88.2			—
				57.0	BK-767	79.4	87.9			—
				63.5	BK-768	79.4	87.7			—
	88.9 (3-1/2")	2.4~2.8	12, 13	19.0	BK-771	81.0	91.1	DM-18	HM-18	SS-18~22
				25.4	BK-772	81.0	90.8			SS-18~22
				32.0	BK-773	81.0	90.6			SS-18~22
				38.0	BK-774	81.0	90.3			SS-18~22
				44.5	BK-775	81.0	90.0			—
				51.0	BK-776	81.0	89.8			—
				57.0	BK-777	81.0	89.5			—
				63.5	BK-778	81.0	89.2			—
	101.6 (4")	8.6	0	19.0	BK-761	79.4	89.5	DM-18	HM-18	SS-18~22
				25.4	BK-762	79.4	89.2			SS-18~22
32.0				BK-763	79.4	89.0	SS-18~22			
38.0				BK-764	79.4	88.7	SS-18~22			
44.5				BK-765	79.4	88.5	—			
51.0				BK-766	79.4	88.2	—			
57.0				BK-767	79.4	87.9	—			
63.5				BK-768	79.4	87.7	—			
101.6 (4")	7.6	1	19.0	BK-771	81.0	91.1	DM-18	HM-18	SS-18~22	
			25.4	BK-772	81.0	90.8			SS-18~22	
			32.0	BK-773	81.0	90.6			SS-18~22	
			38.0	BK-774	81.0	90.3			SS-18~22	
			44.5	BK-775	81.0	90.0			—	
			51.0	BK-776	81.0	89.8			—	
			57.0	BK-777	81.0	89.5			—	
			63.5	BK-778	81.0	89.2			—	
101.6 (4")	7.2	2	19.0	BK-781	82.6	92.7	DM-18	HM-18	SS-18~22	
			25.4	BK-782	82.6	92.4			SS-18~22	
			32.0	BK-783	82.6	92.1			SS-18~22	
			38.0	BK-784	82.6	91.9			SS-18~22	

Easy selection chart for Tube Expanders

Easy selection chart for Tube Expanders

BK Type Easy selection chart (mm)

Type	Tube size			Tube sheet thickness	Expander tool number	Tube Expansion range D		Mandrel number		
	Tube O.D.	Thickness	B.W.G.			Min.	Max.	Drum mandrel	Header mandrel	Short mandrel
BK Type	101.6 (4")	7.2	2	44.5	BK-785	82.6	91.6	DM-18	HM-18	—
				51.0	BK-786	82.6	91.4			—
				57.0	BK-787	82.6	91.1			—
				63.5	BK-788	82.6	90.8			—
	101.6 (4")	6.6	3	19.0	BK-791	84.1	94.3	DM-19	HM-19	SS-19~23
				25.4	BK-792	84.1	94.0			SS-19~23
				32.0	BK-793	84.1	93.7			SS-19~23
				38.0	BK-794	84.1	93.5			SS-19~23
				44.5	BK-795	84.1	93.2			—
				51.0	BK-796	84.1	92.9			—
101.6 (4")	5.6~6.0	4, 5	19.0	BK-801	85.7	95.9	DM-20	HM-20	SS-20~24	
			25.4	BK-802	85.7	95.6			SS-20~24	
			32.0	BK-803	85.7	95.3			SS-20~24	
			38.0	BK-804	85.7	95.1			SS-20~24	
			44.5	BK-805	85.7	94.8			—	
			51.0	BK-806	85.7	94.5			—	
			57.0	BK-807	85.7	94.3			—	
			63.5	BK-808	85.7	94.0			—	
101.6 (4")	5.2	6	19.0	BK-811	87.3	97.4	DM-20	HM-20	SS-20~24	
			25.4	BK-812	87.3	97.2			SS-20~24	
			32.0	BK-813	87.3	96.9			SS-20~24	
			38.0	BK-814	87.3	96.6			SS-20~24	
			44.5	BK-815	87.3	96.4			—	
			51.0	BK-816	87.3	96.1			—	
			57.0	BK-817	87.3	95.8			—	
			63.5	BK-818	87.3	95.6			—	
101.6 (4")	4.6	7	19.0	BK-821	88.9	99.0	DM-20	HM-20	SS-20~24	
			25.4	BK-822	88.9	98.8			SS-20~24	
			32.0	BK-823	88.9	98.5			SS-20~24	
			38.0	BK-824	88.9	98.2			SS-20~24	
			44.5	BK-825	88.9	98			—	
			51.0	BK-826	88.9	97.7			—	
			57.0	BK-827	88.9	97.4			—	
			63.5	BK-828	88.9	97.2			—	
101.6 (4")	3.8~4.2	8, 9	19.0	BK-831	90.5	100.6	DM-20	HM-20	SS-20~24	
			25.4	BK-832	90.5	100.3			SS-20~24	
			32.0	BK-833	90.5	100.1			SS-20~24	
			38.0	BK-834	90.5	99.8			SS-20~24	
			44.5	BK-835	90.5	99.6			—	
			51.0	BK-836	90.5	99.3			—	
			57.0	BK-837	90.5	99.0			—	
			63.5	BK-838	90.5	98.8			—	
101.6 (4")	3.0~3.4	10, 11	19.0	BK-841	92.1	100.4	DM-20	HM-20	SS-20~24	
			25.4	BK-842	92.1	101.9			SS-20~24	
			32.0	BK-843	92.1	101.7			SS-20~24	
			38.0	BK-844	92.1	101.4			SS-20~24	
			44.5	BK-845	92.1	101.2			—	
			51.0	BK-846	92.1	100.9			—	
			57.0	BK-847	92.1	100.6			—	
			63.5	BK-848	92.1	100.4			—	

## Inquiry Sheet

Please provide us following information ( \* must be filled in )

\* Your Name \_\_\_\_\_

\* Company Name \_\_\_\_\_

Division \_\_\_\_\_

\* Company Address \_\_\_\_\_

Postal Code: \_\_\_\_\_

Date to reply (if desired)

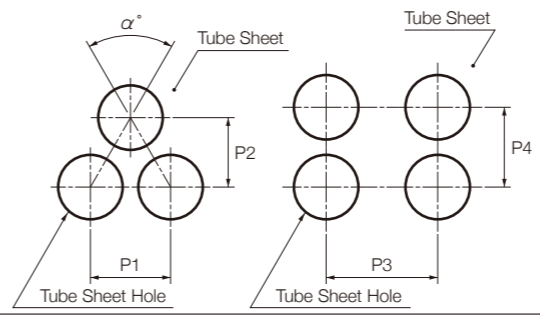
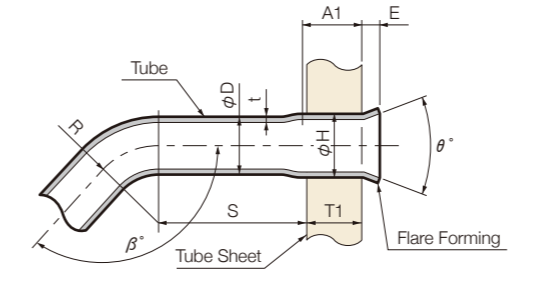
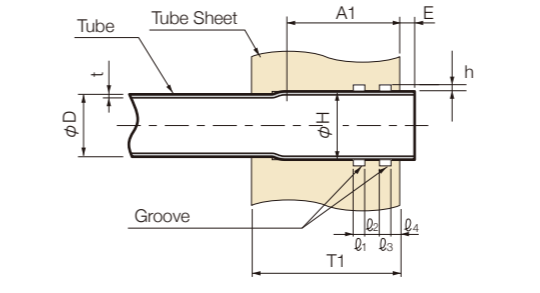
\* Items you are interested in \_\_\_\_\_

\* Phone \_\_\_\_\_

Fax \_\_\_\_\_

E-mail Address \_\_\_\_\_

Please fill in the below chart for your inquiry ( \* must be filled in )

	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>* Tube Size</td> <td>D</td> <td>t</td> </tr> <tr> <td>* Tube Material</td> <td colspan="2"></td> </tr> <tr> <td>* Tube Sheet Hole Pitch and Arrangement</td> <td>P1</td> <td>P2    <math>\alpha^\circ</math></td> </tr> <tr> <td></td> <td>P3</td> <td>P4</td> </tr> <tr> <td>* Tube Sheet Thickness</td> <td>T1</td> <td>T2</td> </tr> <tr> <td>* Tube Sheet Material</td> <td colspan="2"></td> </tr> <tr> <td>* Tube Sheet Hole Diameter</td> <td>H</td> <td>Tolerance</td> </tr> <tr> <td>* Quantity of Tube</td> <td colspan="2"></td> </tr> <tr> <td>* Expansion Length</td> <td>A1</td> <td>A2</td> </tr> <tr> <td>* Tube Wall Reduction Rate</td> <td colspan="2">%</td> </tr> <tr> <td>* Tube end welded to the tube sheet</td> <td colspan="2">Yes / No</td> </tr> <tr> <td>* (In the welding case) Did it happen before/after tube expansion?</td> <td colspan="2">Before / After</td> </tr> <tr> <td>* Type of Lubrication used for Tube Expansion</td> <td colspan="2">Type:</td> </tr> <tr> <td>* Tube Projection</td> <td colspan="2">E</td> </tr> <tr> <td>Tube end shape</td> <td colspan="2">Round / Flat</td> </tr> <tr> <td>Distance between Double Tube Sheet</td> <td>C</td> <td>F</td> </tr> <tr> <td>Flare Angle</td> <td colspan="2"><math>\theta^\circ</math></td> </tr> <tr> <td>Length of straight tube part</td> <td colspan="2">S</td> </tr> <tr> <td>Curve Radius and Angle of Bent Tube Part</td> <td>R</td> <td><math>\beta^\circ</math></td> </tr> <tr> <td>Groove Size and Distance</td> <td><math>\phi_1</math></td> <td><math>\phi_2</math></td> </tr> <tr> <td></td> <td><math>\phi_3</math></td> <td><math>\phi_4</math>    h</td> </tr> </table>	* Tube Size	D	t	* Tube Material			* Tube Sheet Hole Pitch and Arrangement	P1	P2 $\alpha^\circ$		P3	P4	* Tube Sheet Thickness	T1	T2	* Tube Sheet Material			* Tube Sheet Hole Diameter	H	Tolerance	* Quantity of Tube			* Expansion Length	A1	A2	* Tube Wall Reduction Rate	%		* Tube end welded to the tube sheet	Yes / No		* (In the welding case) Did it happen before/after tube expansion?	Before / After		* Type of Lubrication used for Tube Expansion	Type:		* Tube Projection	E		Tube end shape	Round / Flat		Distance between Double Tube Sheet	C	F	Flare Angle	$\theta^\circ$		Length of straight tube part	S		Curve Radius and Angle of Bent Tube Part	R	$\beta^\circ$	Groove Size and Distance	$\phi_1$	$\phi_2$		$\phi_3$	$\phi_4$ h
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