

Clutch cover assemblies for automobiles

1. Scope

This standard covers clutch cover assemblies applicable to dry automotive single-plate clutch disk assemblies (hereinafter referred to as clutch covers). Motorcycles are not included within the scope of this standard.

Note: In this standard units given in { } are conventional units, shown for reference.

2. Purpose

The purpose of this standard is to standardize the clutch cover assemblies, promote rationalization, and assure acceptable quality.

3. Classification

Clutch disks are classified by spring shape, drive system, and fly wheel shape as shown in **Table 1**.

Table 1.

Spring Shape	Drive System	Flywheel Shape	Abbreviation	Remarks
Coil spring	Strap	Pot	CSP	See Appended Fig. 1.
		Flat	CSF	See Appended Fig. 2.
	Lug drive	Pot	CLP	See Appended Fig. 3.
		Flat	CLF	See Appended Fig. 4.
Diaphragm spring	Strap drive	Pot	DSP	See Appended Fig. 5.
		Flat	DSF	See Appended Fig. 6.
	Lug drive	Pot	DLP	See Appended Fig. 7.
		Flat	DLF	See Appended Fig. 8.

Note – Indication abbreviation method. The outside diameter of applicable facing is placed after the abbreviation.

Example CSP-200: Indicates CSP with applicable facing OD 200 mm.

Informative reference – In the use of Appended Fig. 5 and 6 products, patent conflicts are possible (US. PAT. 3130828 expiring Apr. 27, 1981, and B. PAT. 984808 expiring Jun. 18, 1979).

Applicable Standards: Refer to page 9.

Old Standard: JASO 6317

4. Names and Materials of Main Component Parts

As a general rule, the names and materials of main component parts shall conform to **Table 2**.

Table 2

No.	Name	Material	Product hardness (References)	Hardened depth (mm) (Reference)
1	Cover or bracket	SPC, SPH or FC	—	—
2	Pressure plate	FC	HB 172~269	
3	Strap	SK-5	HV 390~510	
4	Clutch spring	Diaphragm spring	SK-5	HV 390~510
		Coil spring	SWP or SWOCV-V	
5	Release lever	S-C	HRC 20~30	
		SPC, SPH, S 15CK or SCM21~22	HV 550min.	0.2min.
6	Release plate	S 15CK, S 12C~S 17C, SPC or SPH	HV 550min.	0.2min.
7	Lever support release bolt or eye bolt	S 33C~S 58C	HRC 14~30	
		SCM, SCr	HRC 27~33	
		S 15CK or S 12C~S 17C	HV 550min.	0.1min.
8	Adjustor nut Spring mounting nut or lock nut	S 15CK or S 10C~S 17C	HV 550min.	0.2min.
		S 33C~S 58C	HRC 14~30	
		SS 41		
9	Pivot ring	SWRH or SWP	HRC 40min.	
		SWRM	HV 500min.	0.2min.
10	Clip	SK-5	HV 390~510	—
11	Spring mounting bolt or Spring mounting rivet	SCM 3~4	HRC 27~37	—
		SS 41 or S 33C~S 38C	—	—
12	Needle roller	SUJ	HRC 56min.	—
13	Pin	S 48C~S 53C	HRC 50min.	—
		S 15CK or S 10C~S 17C	HV 550min.	0.2min.
14	Adjustor bolt	S 15CK or S 10C~S 17C	HV 550min.	0.2min.
15	Return spring	SWP	—	—
16	Strut	SPH, SPC	HV 550min.	0.2min.
17	Spring cap	SPC, or SPH	—	—
18	Lever seat	SPH, SPC or S 10C~S 17C	HV 550min.	0.2min.
19	Pivot plate or washer	SPC, SPH		

Note:

1. Materials shall conform to the following **Japanese Industrial Standards**:

SPC to **JIS G 3141**

SK-5 to **JIS G 4401**

SWPH to **JIS G 3506**

SPH to **JIS G 3131**

SCM to **JIS G 4105**

SCr to **JIS G 4104**

SWOCV-V to **JIS G 3565**

FC to **JIS G 5501**

SUJ to **JIS G 4805**

SWRM to **JIS G 3505**

SS to **JIS G 3101**

S-C to **JIS G 4051**

SWP to **JIS G 3522**

2. The above item numbers correspond to those in **Appended Figs. 1 - 8**.

5.2 Clutch Cover Main Component Tolerances

The tolerances for the clutch cover main components are shown in **Table 4**.

Table 4

Item	Tolerance	Remarks
Imbalance	M is $110 W^{2/3}$ max. In case W is 2.5kg or less, M will be 150 gmm max.	Where M : Imbalance (gmm) W : Weight (mass) (kg) of rotating body
Surface roughness (pressure plate frictional surface)	12.5 S	As per standard specimen JIS B 0659 (Roughness Comparison Specimens)
Installed load	— 10% of standard value	JIS B 7721 (Tensile Testing Machine) or equivalent tester.
Lever height	1. In case of coil spring (A) $\pm 0.5\text{mm}$ for facing 300mm OD or less. maximum difference in lever heights 0.5mm max. (B) $\pm 0.7\text{mm}$ for facing exceeding 300mm OD. maximum difference in lever heights 0.7mm max. 2. In case of diaphragm spring $\pm 1.0\text{mm}$. maximum difference in lever heights 1.0mm max.	Measurement procedure shall conform to 6.1.

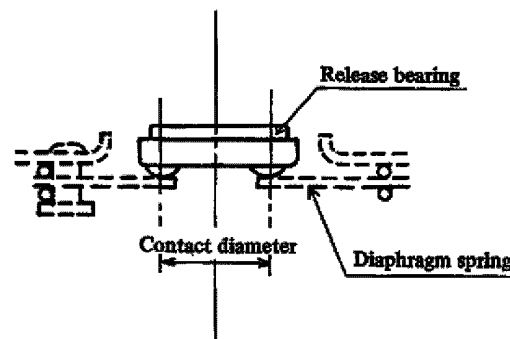
5.3 Contact Diameter of Diaphragm Spring Clutch Release Bearing

The contact diameters are as shown in **Table 5**.

Table 5

Unit : mm

Contact diameter
38
41
44
(45)
47
(48)
50
54
58
62
68



Note: — Avoid using dimensions within parenthesis whenever possible

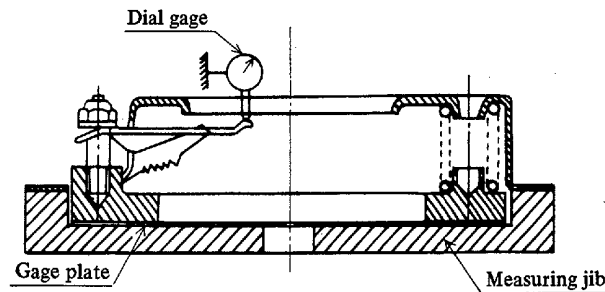
6. Characteristics Test Method

6.1 Lever Height and Lever Mutual Height Difference Measurement Procedure

Use a jig corresponding to the flywheel, and after running it for the prescribed number of release strokes, measure the

lever heights and lever mutual height differences with a dial gauge. In this case, insert a gauge plate corresponding to the compressed thickness of the clutch disc and read the height as shown by the indicator. (See Fig. 1)

Fig. 1



6.2 Load Characteristic Test

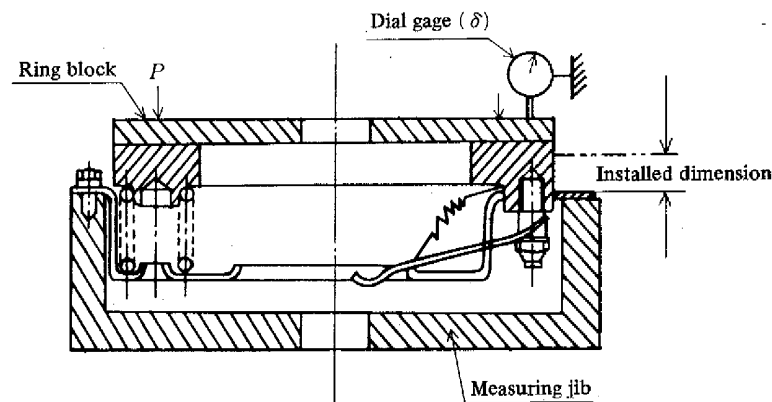
The load characteristic test shall be as follows.

- (1) The tester shall have the following functions. Note : a typical tester is shown in Fig. 2.

(a) Be capable of completely mounting the cover.

- (b) The load P shall act downward, vertical to and uniformly on the pressure plate frictional surface.
- (c) Be capable of reading the load P and the deflection δ .
- (d) P and δ may be effected by manual or automatic means.

Fig. 2



- (2) The test shall be performed as follows :

- (a) Mount the test specimen on the measuring jig with bolts or by other appropriate means, and after actuating once to the maximum release stroke, take the following measurements.
- (b) Press down on the pressure plate and record P and δ incrementally up to the amount corresponding to the maximum release stroke. Then, from this point, decrease the pressure until

returned to the initial position, while again recording the pressured P at the various deflections δ . As a general rule, the weight (mass) of the pressure plate and the ring block, if used, shall be added to P .

- (3) The load characteristics shall be expressed in terms of P_1 against δ_1 , or δ_1 against P_1 . Typical examples are shown in Fig. 3-1 and Fig. 3-2. Specify the indicated position of P .

Fig. 3 -1

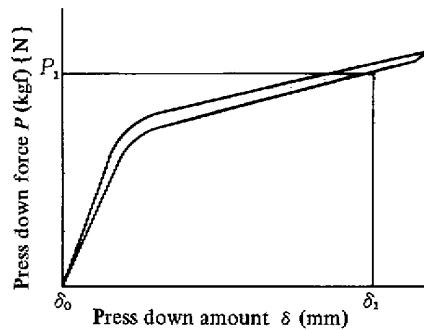
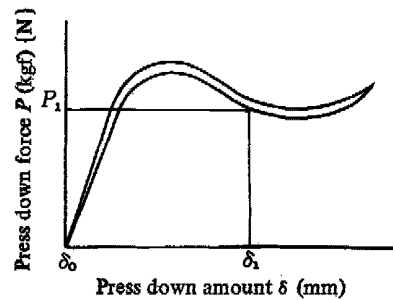


Fig 3 - 2



Where :

δ_1 : Press down amount against P_1

P_1 : Press down force against δ_1

δ_0 : Press down amount = 0, that is, at free state.

6.3 Imbalance Measurement Test

Test procedures shall be determined by the parties concerned.

6.4 Release Performance Test

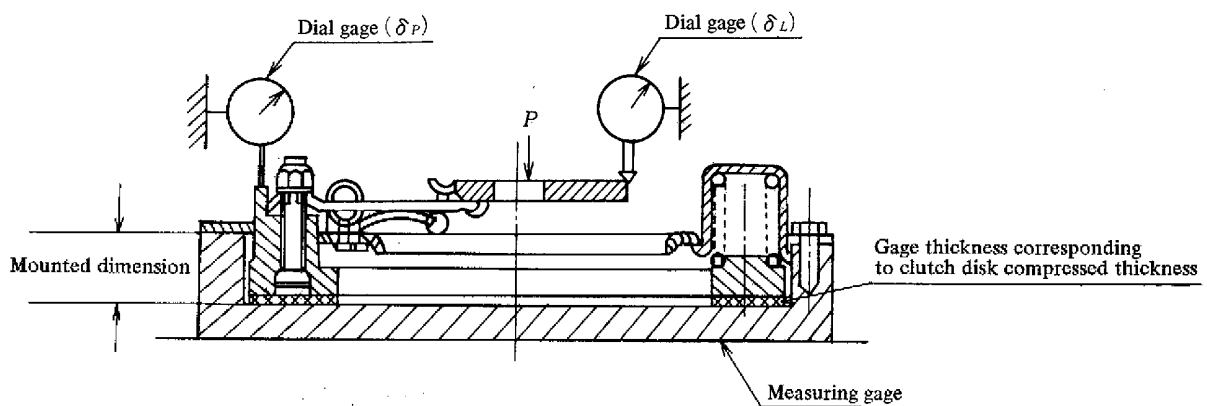
The release performance test shall be as follows :

- (1) The tester shall have the following functions. Note : A typical tester is shown in Fig. 4.

- (a) Be capable of completely mounting the cover.

- (b) The load P shall act downward vertical to and uniformly on the pressure plate frictional surface.
- (c) Be capable of reading the push-down load P , pushed down amount δL and pressure plate operating amount δP .
- (d) P , δL , and δP may be effected by manual or automatic means.

Fig. 4



- (2) The test shall be performed as follows :

- (a) Mount the test specimen on the measuring jig with bolts or by other appropriate means, and after actuating once to the maximum release stroke, take the following measurements.
- (b) Press down on the release lever or release lever plate and incrementally record P , δL , and δP , continuing up to the maximum release stroke.

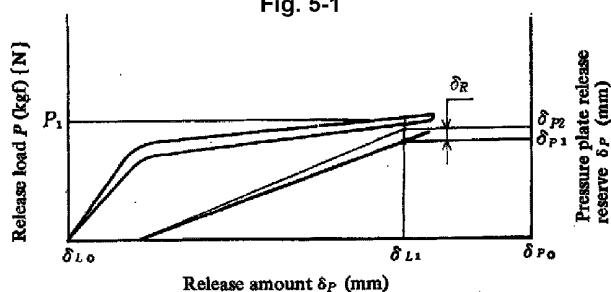
Then, from this point, return to the initial position while again incrementally recording P , δL , and δP .

- (3) The release characteristics shall be expressed in terms of δL_1 , δP_1 , and δR against P_1 , or P_1 , δP_1 , and δR against

δL_1 . Take measurements at three or more points. Specify the indicated position of P .

Typical examples are shown in Fig. 5.1 and 5.2.

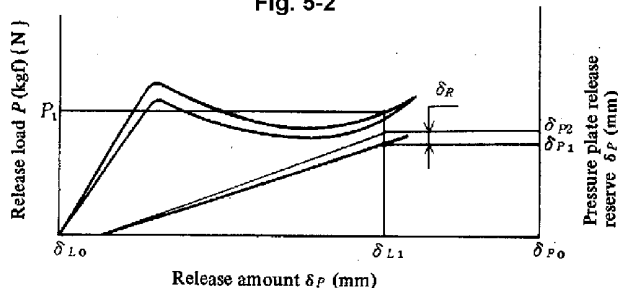
Fig. 5-1



Where

- δL_1 : Release amount against P_1
 δP_1 : Pressure plate minimum release against P_1
 δP_2 : Pressure plate maximum release against P_1
 δR : ($\delta P_2 - \delta P_1$)

Fig. 5-2



Where

- δL_1 : Release amount against P_1
 P_1 : Release load against δL_1
 δP_1 : Pressure plate minimum release against P_1
 δP_2 : Pressure plate maximum release against P_1
 δR : ($\delta P_2 - \delta P_1$)

6.5 Rotational Destructive Test

Test procedures shall be determined by the parties concerned.

7 Construction and Performance Specifications

Construction and performance specification items shall be as follows.

7.1 Construction Specifications

Construction specifications shall consist of the following items.

7.1.1 Type

Types shall be classified by spring shape, drive system, and flywheel shape as shown in Table 1.

7.1.2 Dimensions

- (1) Flywheel mounting hole pitch diameter, hole size, and location. If dowel pin holes are present, the dowel pin hole diameters and location. mm
- (2) Applicable facing size Outside dia. × Inside dia. mm × mm
- (3) Clutch disk thickness when regularly mounted mm

- (4) Flywheel to release lever height when regularly mounted mm
- (5) Flywheel pot amount mm
- (6) Release bearing contact diameter mm
- (7) Release lever ratio :

7.1.3 Weight (mass) kg

7.1.4 Moment of Inertia $\text{kg} \cdot \text{m}^2 \{ \text{kgf} \cdot \text{cm} \cdot \text{s}^2 \}$

7.2 Performance Specifications

Performance specification shall consist of the following items.

7.2.1 Clutch torque capacity $\text{N} \cdot \text{m} \{ \text{kgf} \cdot \text{m} \}$

7.2.2 Installed load

- (1) For the coil spring type
 - (a) Regular installed load N {kgf}
 - (b) Spring constant No. of springs {kgf}/mm × No.
- (2) For the diaphragm spring type
 - (a) Regular installed load N {kgf}
 - (b) Load at worn facing N {kgf}/wear reserve mm

This shall be determined by the parties concerned if the load is specified at some other point. (See Fig.6)

7.2.3 Release stroke

- (1) Regular release stroke mm
- (2) Maximum release stroke mm
- (3) Pressure plate movement/regular release stroke mm/mm

This shall be determined by the parties concerned if the movement is specified at some other point.

- (4) Change in lever height at maximum facing wear mm

7.2.4 Release load

- (1) For the coil spring type
 - Load at regular release
 - Load $N\{kgf\}/\text{Regular release stroke mm}$

- (2) For the diaphragm spring type

Load at regular release

Load $N\{kgf\}/\text{Regular release stroke mm}$

This may be determined by the parties concerned if the load is specified at some other point.

7.2.5 Allowable Rotational Speed $\text{min}^{-1}\{\text{rpm}\}$

Conditions shall be determined by the parties concerned.

7.2.6 Destructive Rotational Speed $\text{min}^{-1}\{\text{rpm}\}$ max.

Conditions shall be determined by the parties concerned.

7.2.7 Durability Performance

Conditions shall be determined by the parties concerned.

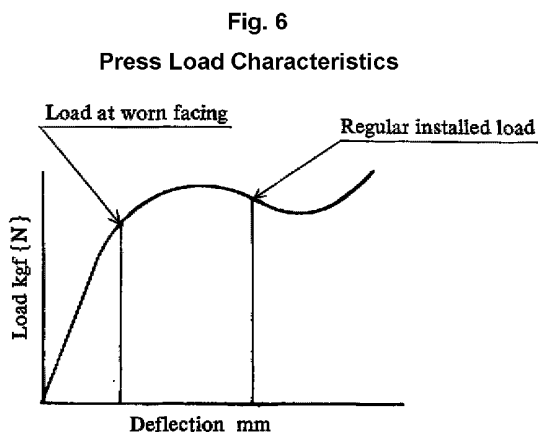
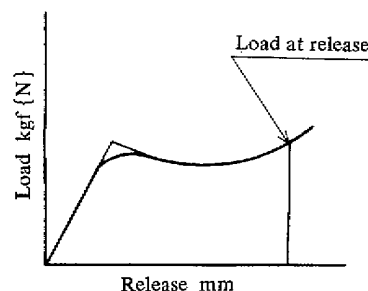


Fig. 7
Release Load Characteristics

**8. Inspection****8.1 Inspection Items**

- (1) Appearance
- (2) Materials
- (3) Dimensional
- (4) Load characteristic
- (5) Release characteristic

8.2 Appearance Inspection

The product shall present a well finished appearance and be free of noticeable scratches, burrs, and other defects.

8.3 Material Inspection

Materials shall conform to the requirements prescribed in 4.

8.4 Dimension Inspection

Dimensions shall conform to the requirements prescribed in 5.

8.5 Load Characteristic Inspection

When tested in accordance with 6.2, load characteristics shall conform to the requirements agreed to by the parties concerned.

8.6 Release Characteristic Inspection

When tested in accordance with 6.4, release characteristics shall conform to the requirements agreed to by the parties concerned.

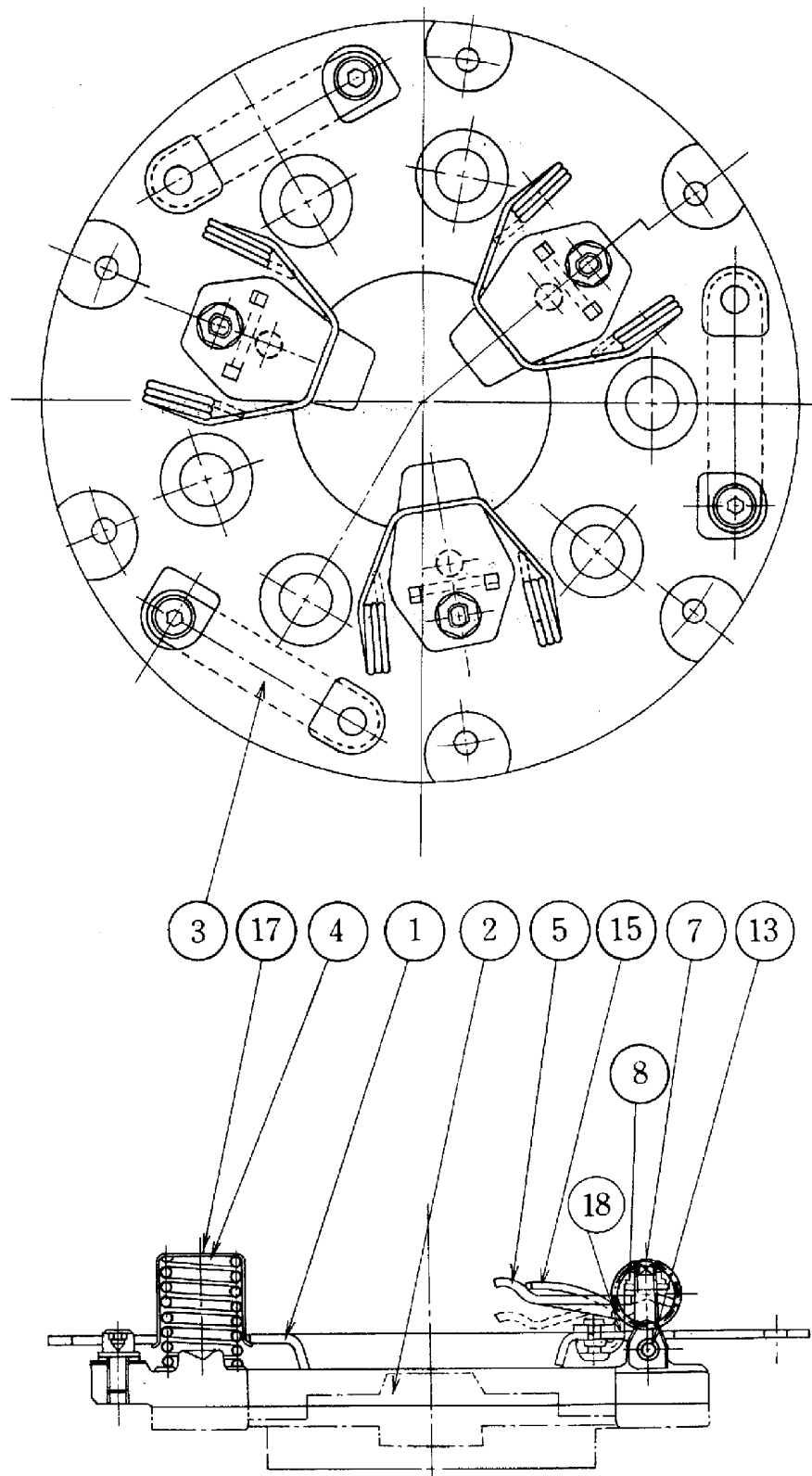
9. Marking

The manufacturer's name or mark and the manufactured year and month or a suitable representation thereof shall be indelibly marked in clear view on the clutch coffer.

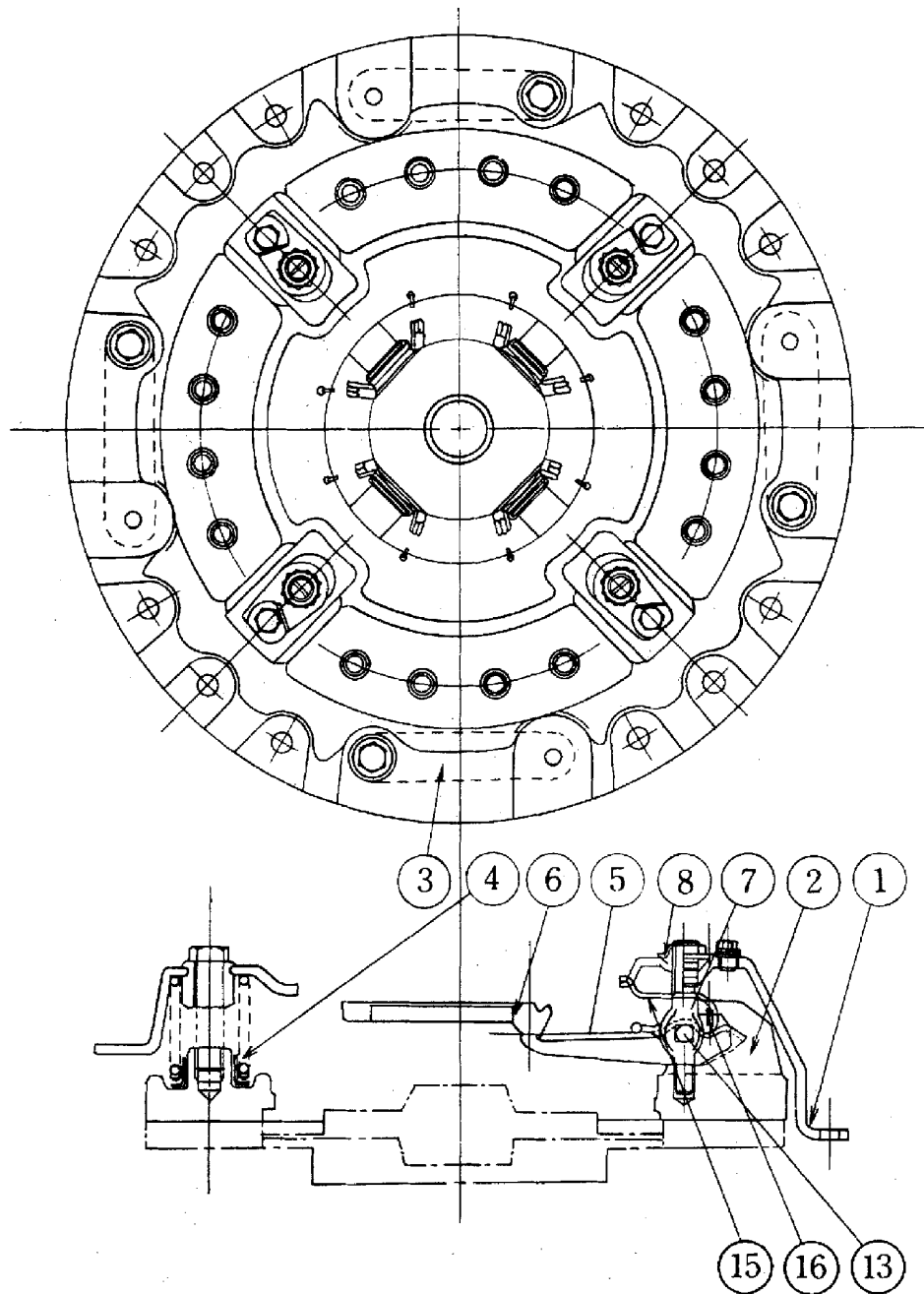
Applicable Standards

- JIS B 0659** (Roughness Comparison Specimens)
- JIS B 7721** (Tensile Testing Machines)
- JIS D 4311** (Clutch Facings for Automobiles)
- JIS G 3101** (Rolled Steel for General Structure)
- JIS G 3131** (Hot-Rolled Mild Steel Plate, Sheet and Strip)
- JIS G 3141** (Cold Rolled Carbon Steel Sheets and Strip)
- JIS G 3505** (Low Carbon Steel Wire Rods)
- JIS G 3506** (High Carbon Steel Wire Rods)
- JIS G 3522** (Piano Wires)
- JIS G 3565** (Oil Tempered Chrome Vanadium Alloy Steel Valve Spring Quality Wire)
- JIS G 4051** (Carbon Steel for Machine Structure Use)
- JIS G 4104** (Chromium Steels)
- JIS G 4105** (Chromium Molybdenum Steels)
- JIS G 4401** (Carbon Tool Steels)
- JIS G 4805** (High Carbon Chromium Bearing Steels)
- JIS G 5501** (Grey Iron Castings)
- JASO C 102-76** (Clutch Disk Assemblies for Automobiles)

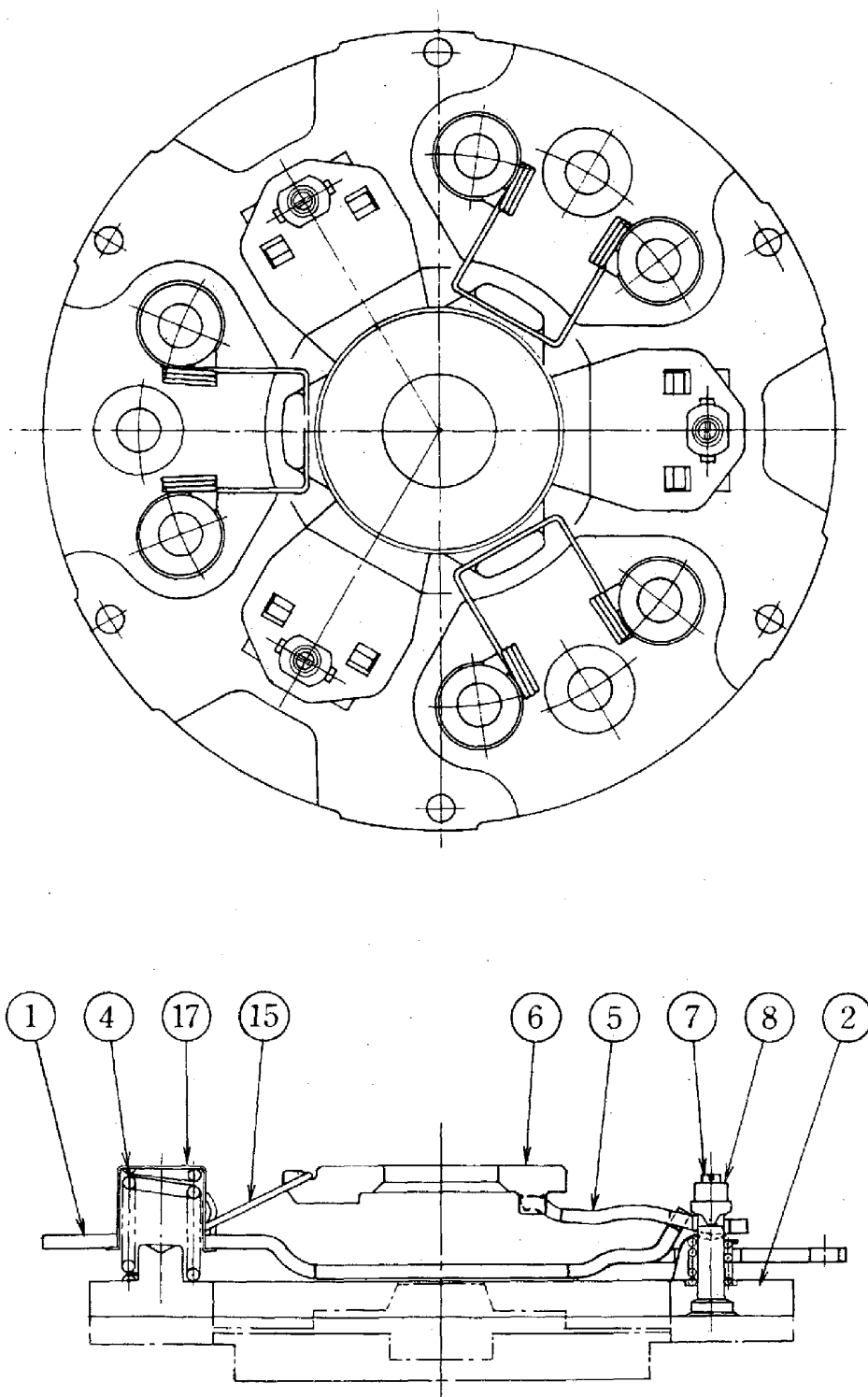
Appended Fig. 1
CSP



Appended Fig. 2
CFS

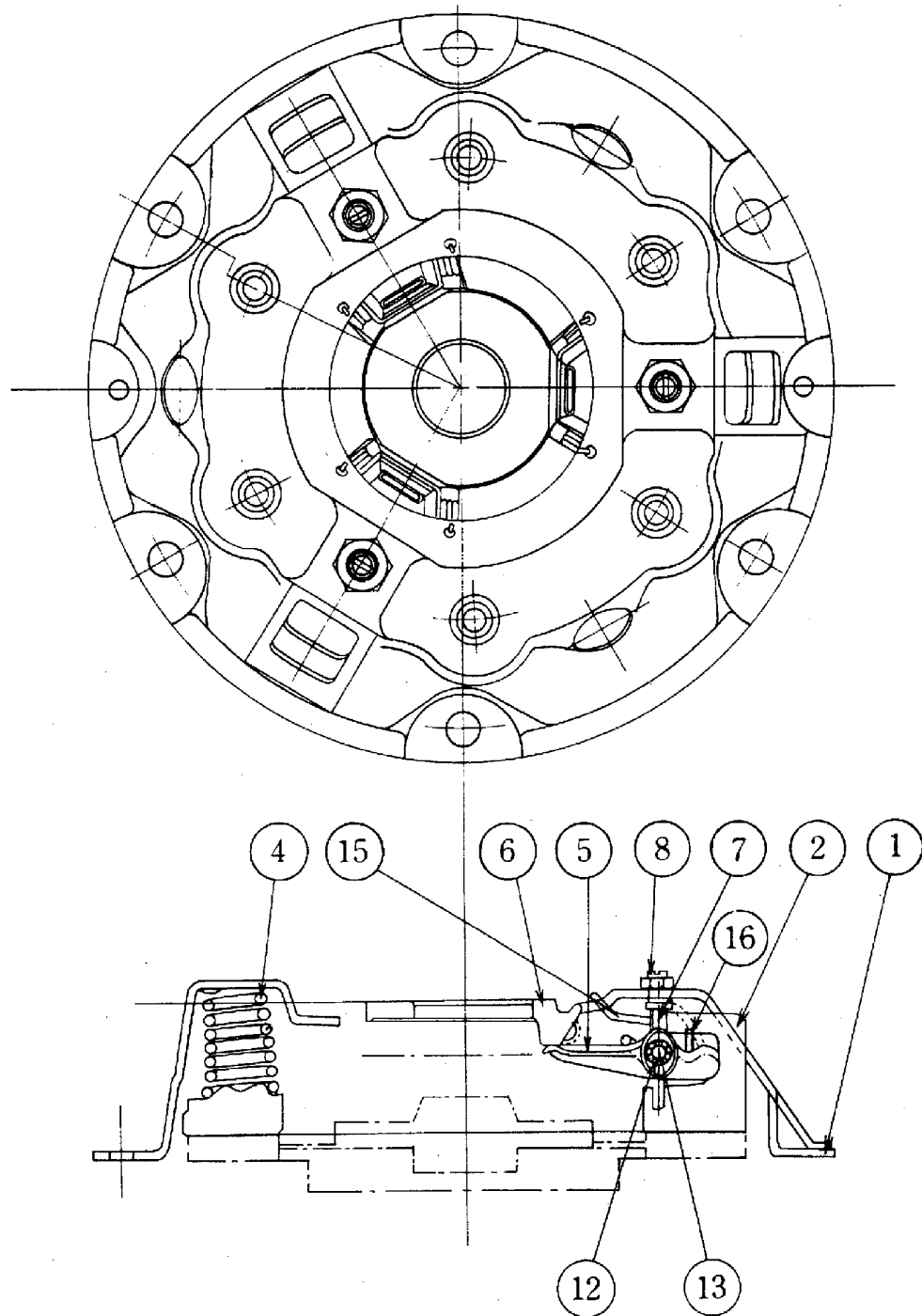


Appended Fig. 3
CLP

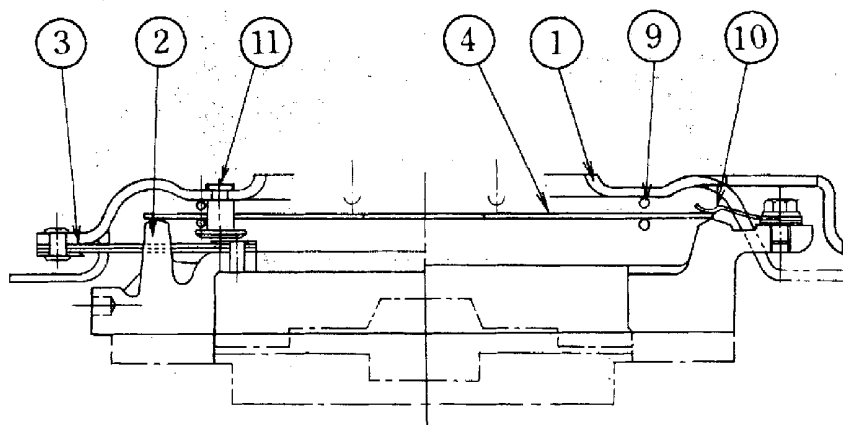
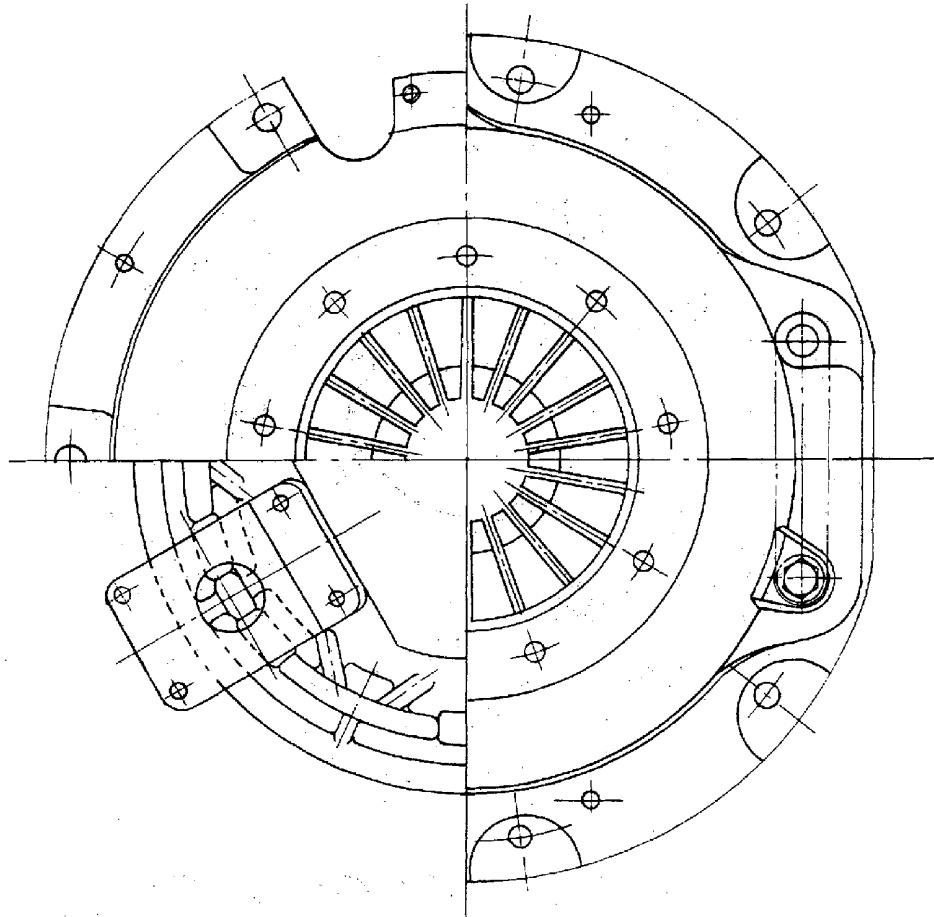


Appended Fig. 4

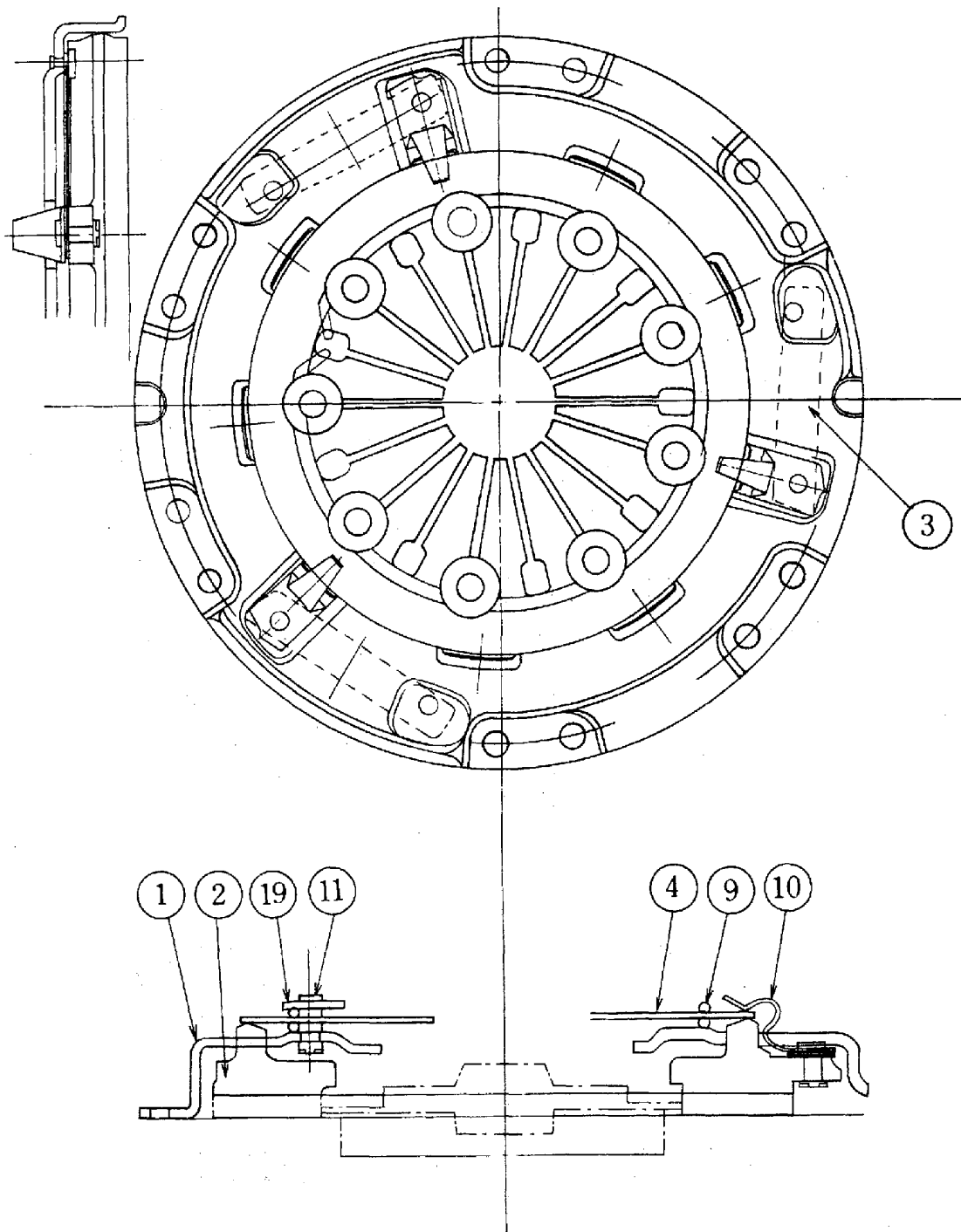
CLF



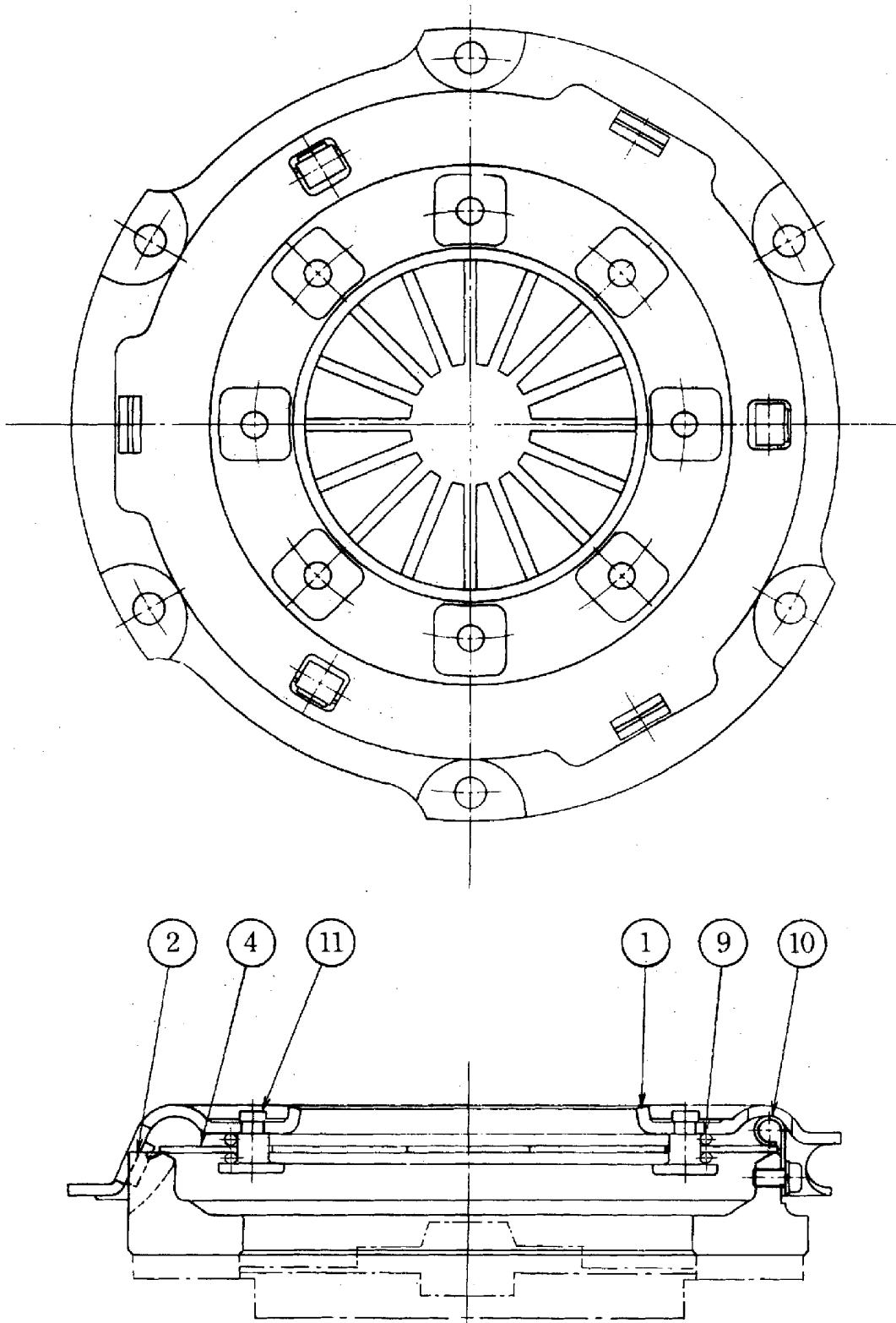
Appended Fig. 5
DSP



Appended Fig. 6
DSF

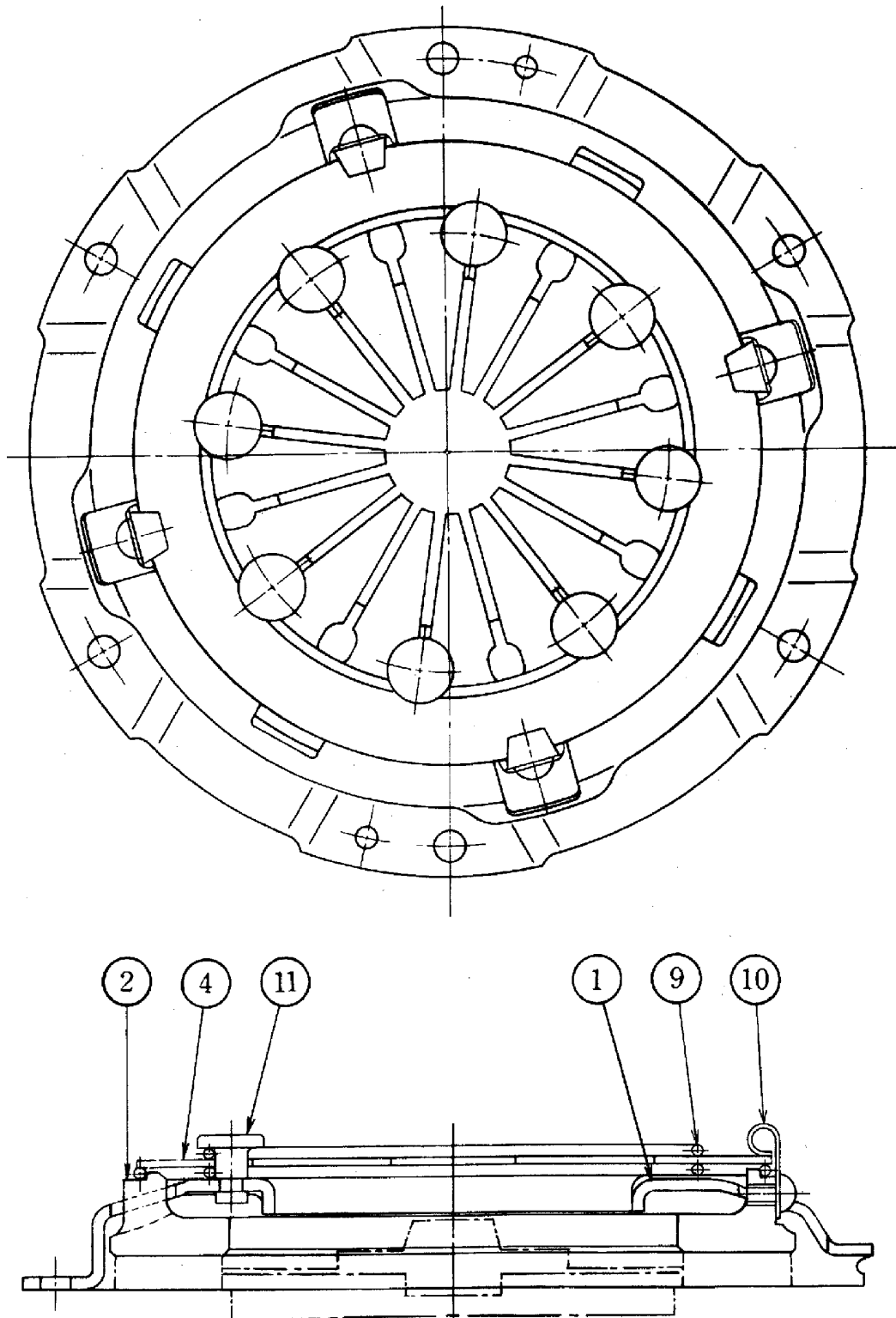


Appended Fig. 7
DLP



Appended Fig. 8

DLF



Reference

Calculation of Cover Mounting Bolt Pitch Diameter

1. Calculation shall be by the following equation:

$$D_A = D_P + 2(C + t + R + O + r)$$

$$D_B = D_P + 2(C + O + r)$$

where D_P : Pressure plate outside diameter

D_A : Flywheel flat type cover mounting bolt pitch diameter

D_B : Flywheel pot type cover mounting bolt pitch diameter

C : Clearance between pressure plate

outside diameter and cover or flywheel

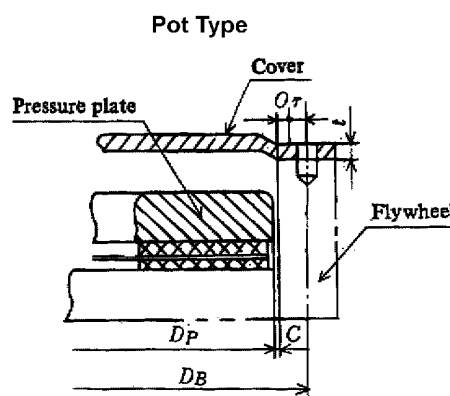
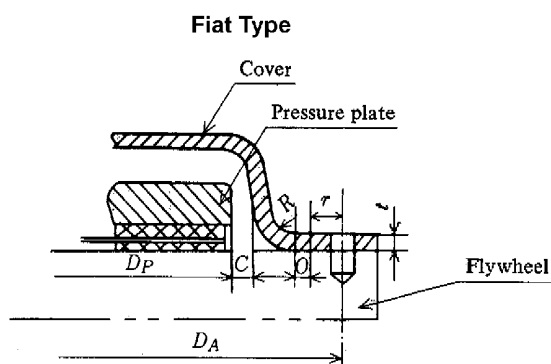
inside wall

t : Cover thickness

R : Radius of cover, bent portion

O : Distance between mounting bolt seat radius and

r : Mounting bolt seat radius



2. The values of the various parts used in the equation and the calculated values are shown in the **Reference Table**

Reference Table

unit : mm

Facing Outside Diameter	D_P	C	t	R	O	r	D_A	D_B
118	121	1.5	2.3	2.3	0.5	6.0	147	137
125	128	1.5	2.3	2.3	0.5	6.0	154	144
132	135	1.5	2.3	2.3	0.5	6.0	161	151
140	143	1.5	2.3	2.3	0.5	6.0	169	159
150	153	1.5	2.3	2.3	0.5	6.0	179	169
160	163	1.5	2.6	2.6	0.5	6.0	189	179
170	173	1.5	2.6	2.6	0.5	8.0	203	193
180	183	1.5	2.6	2.6	0.5	8.0	213	203
190	193	1.5	3.2	2.6	0.5	8.0	225	213
200	203	2.0	3.2	3.2	0.5	8.0	237	224
212	215	2.0	3.6	3.6	0.5	8.0	250	236
224	227	2.0	4.0	4.0	0.5	8.0	264	248
236	239	2.0	4.0	4.0	0.5	8.0	276	260
250	253	2.0	4.0	4.0	0.5	8.0	290	274
265	269	2.0	4.0	4.0	0.5	8.0	306	290
280	284	2.0	4.0	4.0	0.5	8.0	321	305
300	304	3.0	4.0	4.0	0.5	8.0	344	328
315	319	3.0	4.0	4.0	1.0	8.0	359	343
335	339	3.0	4.5	4.5	1.0	9.5	384	366
355	359	3.0	6.0	6.0	1.0	9.5	410	386
375	379	3.0	6.0	6.0	1.0	9.5	430	406
400	404	3.0	6.0	6.0	1.0	11.0	459	435
425	429	3.0	6.0	6.0	1.0	11.0	484	460
450	454	3.0	6.0	6.0	1.0	11.0	509	485

Explanatory Notes for JASO C 101-89 Clutch cover assemblies for automobiles

Introduction

This standard was issued as **JASO 6317-72** (Clutch Cover Assemblies for Automobiles) on Dec. 20, 1963 and revised on Jun. 15, 1972. It was revised over the course of five deliberations into the present form for current and future use. (The following item numbers are the same as those in the **main text**.)

3. Classification

In previous standards, clutch covers were classified by spring shape, load system, drive system, flywheel shape, and cover shape with a total of 18 types. However, since clutch cover designations were in accordance with the spring shape, drive system, and flywheel shape, It was considered be simpler and easier to have the classification conform to the abbreviations, thus the revision. The abbreviations CIPI and CLFI are now obsolete and were deleted.

4. Names and Materials of Main Component Parts

Product hardness of the strap, diaphragm spring, and clip was revised from HCR 40-50 to HV 39-510 as it is more appropriate to specify HV for measuring the product hardness of thin sheet products.

5. Principal Dimensions

5.1 Pressure Plate Size and Cover

- (1) Applicable facing and other dimensions not given in **JIS D 4311**, but that are widely used at present cannot be eliminated for the time being, are included, but are shown enclosed with double parenthesis.

(Outside diameter) x (Inside diameter) 236 x ((165))
((255))x((170)) ,

- (2) The pitch diameters of the mounting bolts for covers that are in actual use were studied. Those not in use at present were deleted and new ones that have come into greater use were added.

Facing Outside Diameters Deleted and Added

Facing Outside Diameter	Deleted	Added
150	160	166
160	200 179	188 184
180	200	213
190	—	204.2
200	200 248	236 237
((215))	234 244.8 238	252 251
224	—	264
225	246 298 311	—
236	280	276
((240))	262	280
250	—	290
255	—	298
260	290	—
275	306 311	311(Flat type)
300	339	—
325	370 360	368
380	409	—
410	—	445

5.2 Clutch Cover Main Component - Tolerances

- (1) "M value 200 gmm or less" was revised to "W value 2.5 kg or less" for the purpose of clarifying the Imbalance expression.

Where M : Imbalance (gmm)

W : Weight (mass) of rotating body (kg)

The above r10te Was transferred to the Remarks column to match **C 103-76** (Clutch Disk Assemblies).

- (2) In the installed load, "Specified Value" was revised to "Standard Value".
- (3) Upon surveying the parts manufacturers' production capacity, the lever height accuracy specification point was changed from a facing Outside diameter of "250 mm max." to "300 mm max." .

6. Characteristics Test Method

6.2 Load Characteristics Test

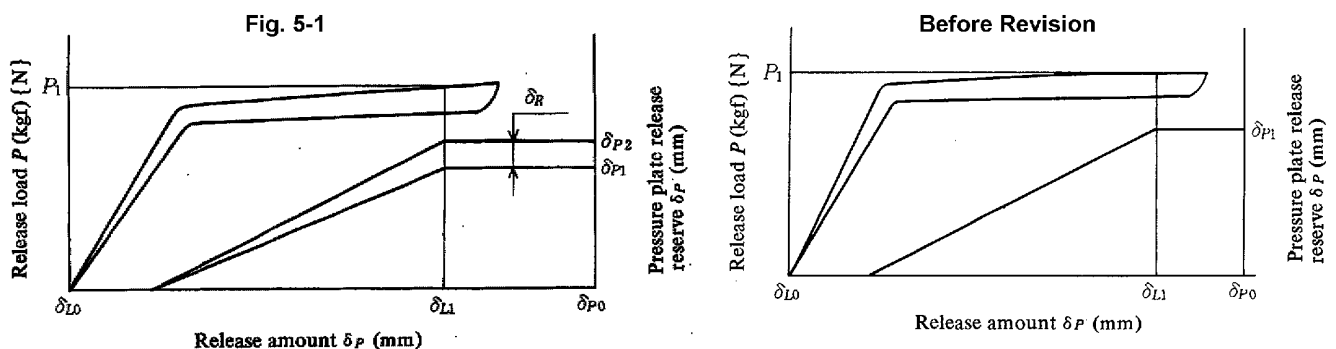
It was concluded that in the pressure plate of heavier weight (mass), the weight (mass) of the ring block should also be added to P. Thus, (2). (b) "When the ring block is used, its weight (mass) shall be added to P" was revised to read "As a general rule, the weight (mass) of the pressure plate and the ring block, if used, shall also be added to P".

6.3 Imbalance Measurement Test

In the Imbalance measurement test, it was suggested that the rotating speed should be concretely specified. However, it was decided that this would be difficult because of the differences in the performances of the testers used at present. Thus, the addition of **63** in which the test is determined by the parties concerned.

6.4 Release Characteristic Test

In the working of the pressure plate, it was proposed that three or more places be measured and expressed in minimum value difference. Thus, (3) was revised from "The release characteristics shall be expressed in terms of $\delta P1$ against $P1$ or $P1$ against $\delta P1$. Typical examples are shown in **Fig. 5.1** and **5.2**. The indicated position of P shall be specified. When $\delta P1$ is measured at two or more places, the minimum value shall be indicated." to "The release characteristic shall be expressed in terms of $\delta L1$, $\delta P1$, and δR against $P1$, or $P1$, $\delta P1$ and δR against $\delta L1$. Take measurements at three or more places. Specify the indicated position of P. Typical examples are shown in **Fig. 5.1** and **5.2**."



Accompanying the revision, " $\delta P1$: Pressure plate release against $P1$ " Was revised to " $\delta P1$: Pressure plate minimum release against $P1$ ", and $\delta P2$ and δR added.

Other

A proposal to standardize the facing outside diameters against the actual values of the cover main parts was presented by the Automotive Parts Industry Association, together with their strong recommendation that it be standardized. The sectional committee, concluded that the actual values cannot be directly adopted at the present stage. However, the values were shown as reference in "Cover Principal Values Classified by Facing Outside Diameters". It is desirable that the actual values be reviewed and standardized in the future.

5. Principal Dimensions

Pressure plate sizes and cover installation dimensions shall conform to **Table 3**.

5.1 Pressure Plate Size and Cover

Table 3

Applicable facing size		Pressure plate			Cover mounting bolt pitch diameter				Cover mounting bolt diameter
Out side diameter	Inside diameter	Outside diameter		Inside diameter	Flat type		Pot type		
		(Recom- mended value)	(Actual value)	(Recom- mended value)	(Recom- mended value)	Actual value (Reference)	(Recom- mended value)	Actual value (Reference)	
118	85	121		(Facing inside diameter) — 3	147		137		6 or 8
125	90	128			154		144		
132	95	135			161		151		
140	100	143			169		159		
150	100 110	153	152		179		169	166 170	
160	110	163	163 162		189	192	179	175 184 188	
170	110	173	172		203	200 213	193		
180	125	183	183 186		213	222.25 213 216	203		
《184》	《127》	《187》	186		—	222.25	—		
190	132	193	194		225	237	213	204.2	
200	130 140	203	203		237	238 240 237 236	224		
212	《140》 150	215			250	264	236		
(215)	(150)	(218)	216 217		—	247 251	—	252	
224	150 160	227	227 228		264	264	248		
(225)	(150)	(228)	228 227 262 278			266 270 264			
236	170 《165》	239			276	276	260		8 or 10
(240)	(150) (160)	(243)	242 244			278 280		270	
250	160	253			290	290	274		
《255》	《170》	《258》	262	—	298	—			
(260)	(170)	(264)	262 263	(Facing diameter) — 4		298		10 or 12	
275	175 180	279	278 280		316	320 311	300		
300	170 180 190	304	304 302		344	350 368	328		
325	200 210	329	330 336		369		353		
350	210 220	354	353		405		381		375
380	220 240	384	384		435		411		405
400	236 《250》	404	406		459		435		456
410	《250》 260 270	414	415		469		445		438.15 445 456
430	250	434	434		489		465		456
457	280	461	460		516		492		486

Remarks : 1. Sizes within parenthesis should be avoided whenever possible. Sizes within parenthesis are the same as those within parenthesis in **JIS D 4311**. Those within double parenthesis are not specified in **JIS D 4311**.

2. On new designs, the mounting bolt pitch diameter should be made to the recommended value whenever possible.

3. Applicable facing dimensions conform to **JASO C 102-76**.

Explanatory Note Table Cover Principal Values Classified by Facing Outside Dia.

Facing outside diameter (mm)	Pot or flat classification	Cover mounting dimensions														Classification	Diaphragm classification	Lever height (mm)
		Plain holes				Reamed holes												
		φ DB	θ B	φ dB	Q'ty	φ DN	LN ₁	LN ₂	LN ₃	LN ₄	LN ₅	LN ₆	φ dN	Q'ty				
150	P	170	40	6.5	4	(173)	—	—	15.02	85.19	85.19	15.02	7	2	A	D	34	
	P	166	50	6.5	4	166	35.08	75.22	—	—	47.60	67.99	6.2	2	A	D	21	
160	P	184	50	8.5	4	(184)			8.02	91.65	91.65	8.02	8.2	2	A	D	32	
	P	175	60	6.5	6	(175)	0	87.5	87.5	0			6	2	A	D	24.3	
	F	192	50	6.5	4	(192)	—	—	8.37	95.64	95.64	8.37	6.2	2	A	D	24	
	F	192	50	6.5	4	(192)	40.57	87.01	—	—	55.06	78.64	6.2	2	A	D	24.5	
165	P	180	45	6.5	6										A	D	26	
180	F	216	54	8.5	6	(216)	3.91	111.93	57.23	91.58	77.37	50.70	6	3	A	D	30	
	F	216	54	8.5	6	—	0	112	54	93.53	93.53	54	6	3	A	D	30	
	F	213	60	8.5	6	213	32.91	101.29	79.14	71.26	104.17	22.14	8	3	A	D	32~35.5	
184	F	222.25	60	8.5	4	(222.5)	—	—	0	111.13	113.13	0	8.2	2	A	D	33	
190 200	F	237	44.6	8.5	6	(237)	59.25	102.62	102.62	59.25	18.5	0	8	3	A	D	36.5	
200	F	240	60	8.5	6	(240)	0	120	60	103.9	103.9	60	6	3	A	D	32~33	
	F	236	60	8.5	6	(236)	0	118	59	102.19	102.19	59	8	3	A	D	31	
200	F	237	44.6	8.5	6	(237)	59.25	102.62	102.62	59.25	118.5	0	8	3	A	D	36.5	
212	F	264	47.3	8.5	6	(264)	66	114.32	114.32	66	132	0	8	3	A	D	36	
215	F	247	60	8.5	6	(247)	0	123.5	61.75	106.95	106.95	61.75	8	3	A	D	33	
224	F	264	47.3	8.5	6	(264)	66	114.32	114.32	66	132	0	8	3	A	D	36.4	
225	F	270	60	8.5	6	(270)	41	128	100.5	90.5	134.5	29	6	3	A	D	34~44	
236	F	276	42.5	8.5	6	(276)	66.9	120.70	118.29	71.08	137.78	24.1	8	3	A	D	36.5	
240	F	280	60	8.5	9	(280)	52.44	129.8	110.32	86.19	139.23	14.63	6	3	B	D	38.5	
250	F	290	60	8.5	6	(290)	43.6	138.29	106.91	97.96	141.56	31.38	6	3	A	D	37.5	
255 260	F	298	45	8.5	6	(298)	0	149	74.9	129.04	129.00	74.9	10	3	A	D	40	
275	F	311	60	8.5	6	(311)	0	155.5	77.75	134.67	134.67	77.75	10	3	A	D	41.8	
275	F	320	30	8.5	12	(320)	158.62	208.8			158.62	20.88	6	2	E	D	43.3~45	
300	F	350	30	10.5	10	(350)	0	175	175	0			10 10.2	2	E	D	45~46.5	
325	F	368	30	10.5 11	10	(368)	0	184	184	0	—	—	10	2	E	D	46.9~63	
350	P	375	30	10.5	8	(375)	—	—	0	178.5	178.5	0	10	2	D	C	77	
380	P	405	30	10.5	8	(405)	175.37	101.25	202.25	0	—	—	10	2	D	C	77	
410	P	445	25	12.5	12	(445)	48	217			48	21.7	10	2	E	C	70.5	
430 (400 410)	P	456	30	11 12.5	12	(456)	96.36	206.64	186.77	130.78	—	—	10	2	C	C	77	
457	P	486	24	10.5	15		468.60~468.50								C	C	100	

Notes

1. Classification D indicates diaphragm spring, C indicates coil spring.
2. Classification A – E is in accordance with Fig. A – E.

