

Side openings for automobile power take-offs

1. Scope

This standard shall be applied to the take-off opening of power take-offs (hereinafter referred to as PTO) mounted on the side surface of the transmission for automobiles.

2. Position, shape and dimensions of the take-off opening

Take-off opening shall be positioned on the left side about the driving direction of the vehicle. Type, shape and dimensions shall be in accordance with those specified in Table 1.

Table 1

Unit: mm

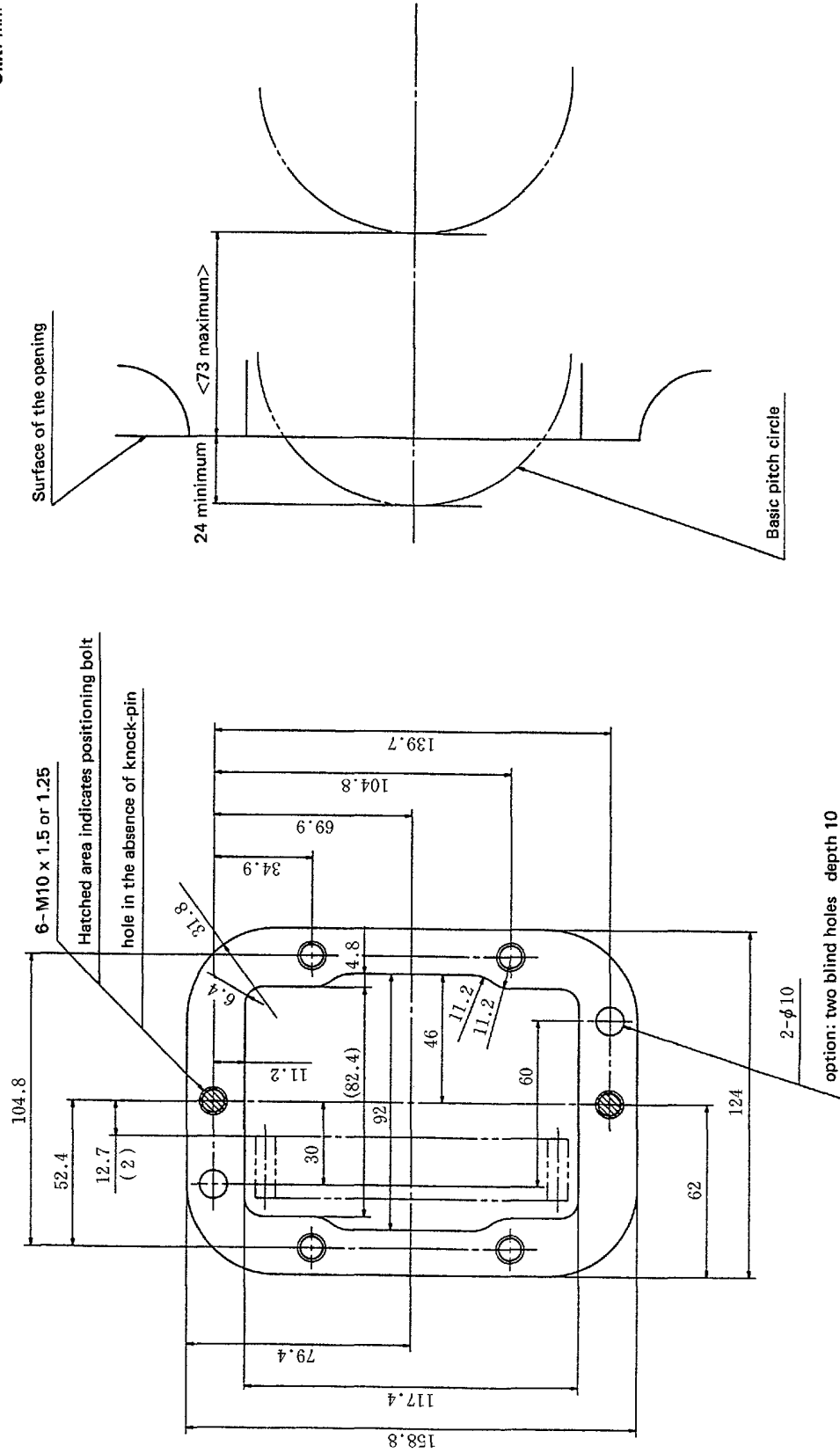
Classification and dimensions	Classification by position of counterpart gear of PTO	Shape and dimensions of PTO		
		Type	Nominal dimension	Attached fig.
Regular type	Type A ⁽¹⁾	S1	117.4 x 82.4	Attached fig. 1-1
	Type B ⁽²⁾	S2		Attached fig. 1-2
Large type	Type A ⁽¹⁾	L1	160 x 120	Attached fig. 2
	Type B ⁽²⁾	L2	184.2 x 127	Attached fig. 3
		L3	210 x 120	Attached fig. 4

Notes ⁽¹⁾: Type A shall be defined as being a type in which the counterpart gear of PTO is protruding from the opening of the transmission.

⁽²⁾: Type B shall be defined as being a type in which the counterpart gear of PTO is positioned inside the opening of the transmission.

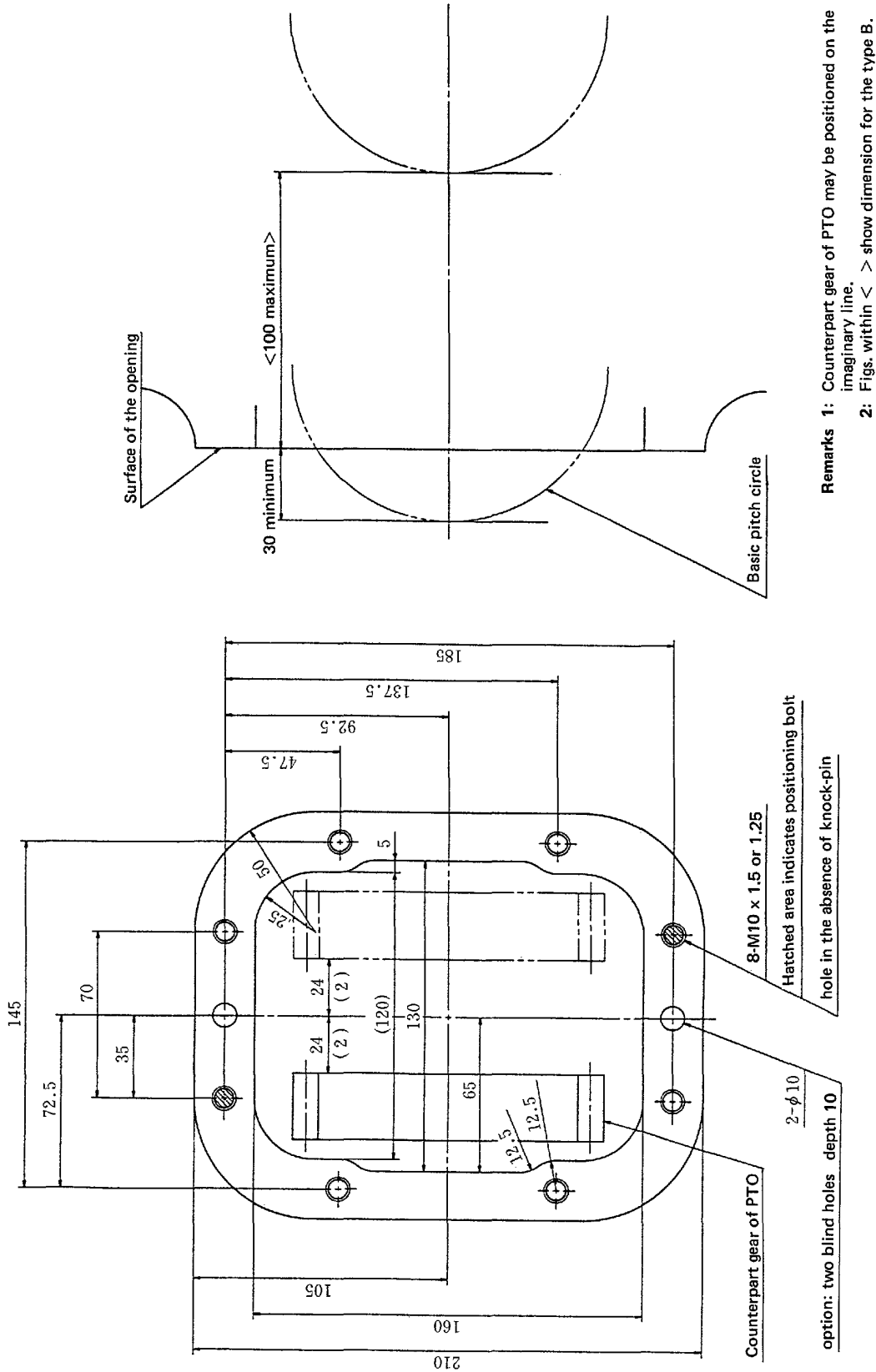
Attached fig. 1-1 For standard type (type S1)
type A and type B

Unit: mm

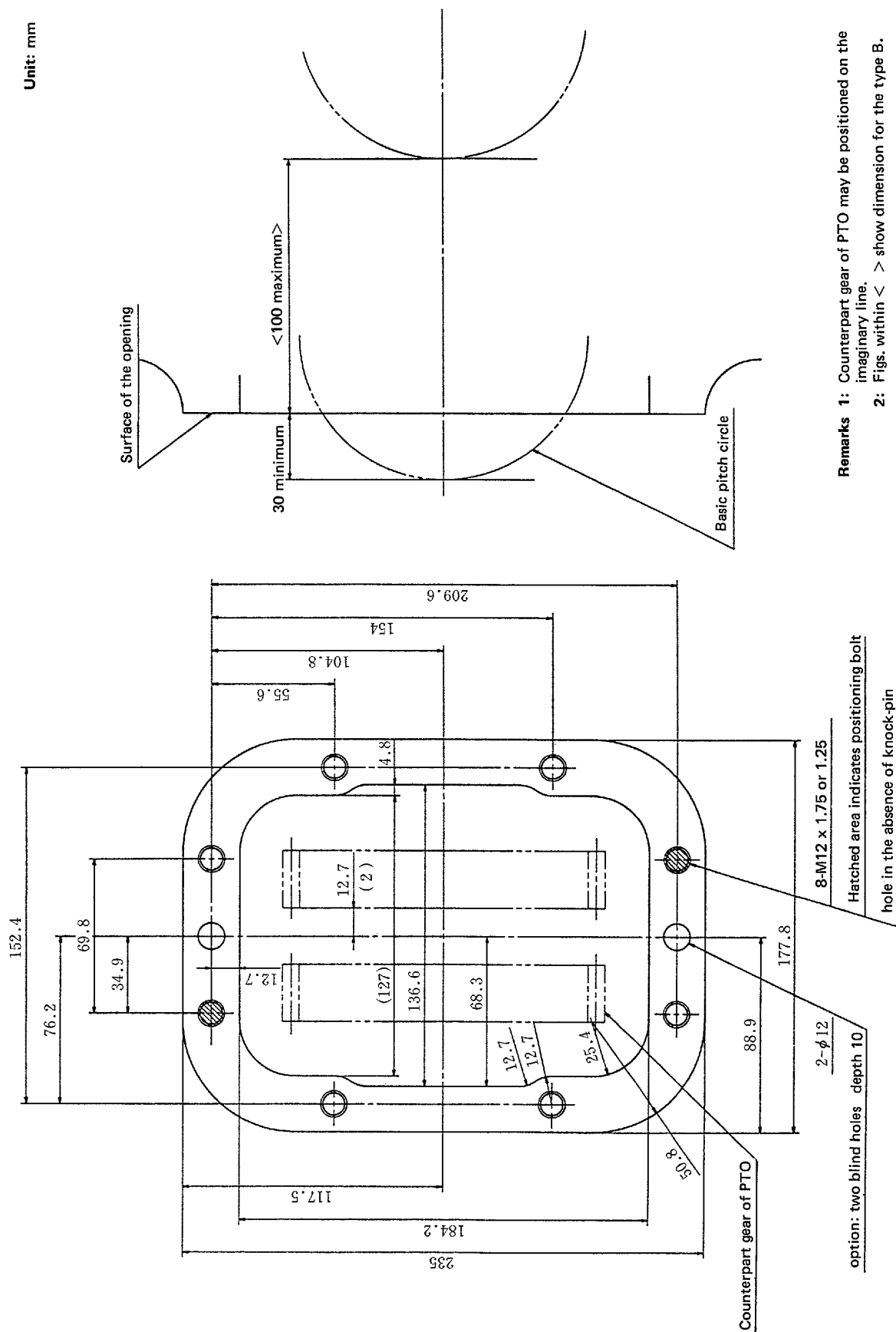


Remarks 1: Counterpart gear of PTO may be positioned on the imaginary line.
2: Figs. within < > show dimension for the type B.

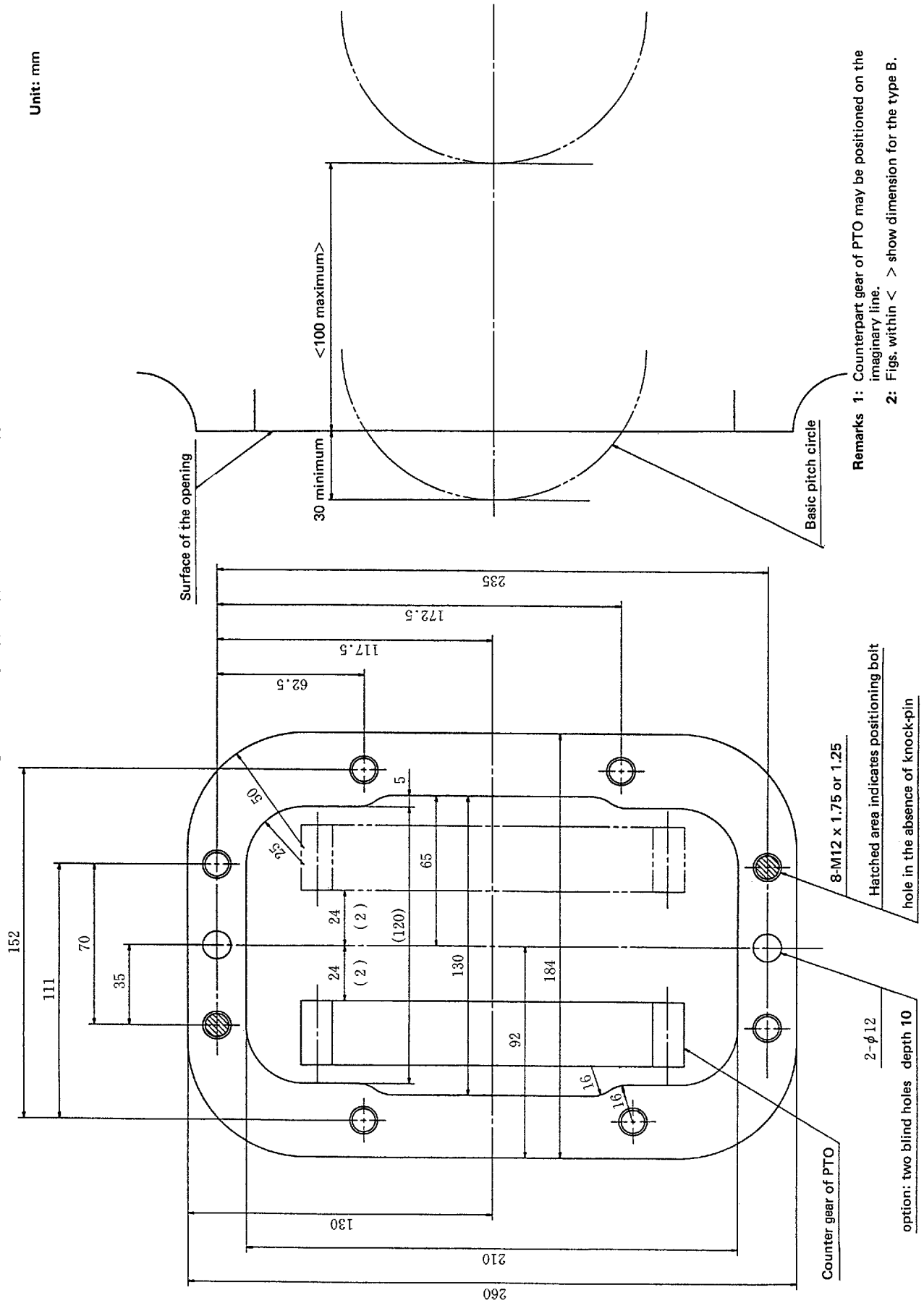
Attached fig. 2 For large type (type L1)
type A and type B



Attached fig. 3 For large type (type L2) type A and type B



Attached fig. 4 For large type (type L3) type A and type B



Remarks 1: Counterpart gear of PTO may be positioned on the imaginary line.
2: Figs. within < > show dimension for the type B.

Explanatory note on JASO C 205-91 Side openings for automobile power take-offs

This explanatory notes explains the stipulated matters in the main articles and the related matters of this standard and is not a part of the standard.

Preface

In these several years, the utilization of automobile engine power has become frequent more and more accompanied by the rapid advancement and spread of special equipment vehicles. Until now, each chassis manufacturer has hitherto determined the dimensions, construction, and performance of the power take-off individually. This fact is unfavorable for the development or advancement of special equipment vehicles. In addition, kind of PTO has been increasing with the increase of kind of chassis.

On the other hand, from the worldwide view, the revision of the standard based on the conformity with the ISO Standard has been requested because the ISO 7804 standard was established in 1985. Then, the Chassis Technical Committee of Society of Automotive Engineers of Japan, Inc. established the JASO Power Take-off Subcommittee as a revised item in the fiscal year of 1990. For the revision of the standard, the draft of this standard was prepared by obtaining information through a questionnaire, etc. as well as by referring the company standard of each chassis manufacturer. After being deliberated thoroughly by the Chassis Technical Committee in January 1991, it was brought up for discussion of the Standard Committee in February 1991 and was approved. In addition, because the power take-off is a device to be subordinate to transmission, the number of JASO standard was changed from E 001-73 to C 205-91 at the time of re-examination in 1990.

Course of preparation of the standard and its re-examination course of preparation

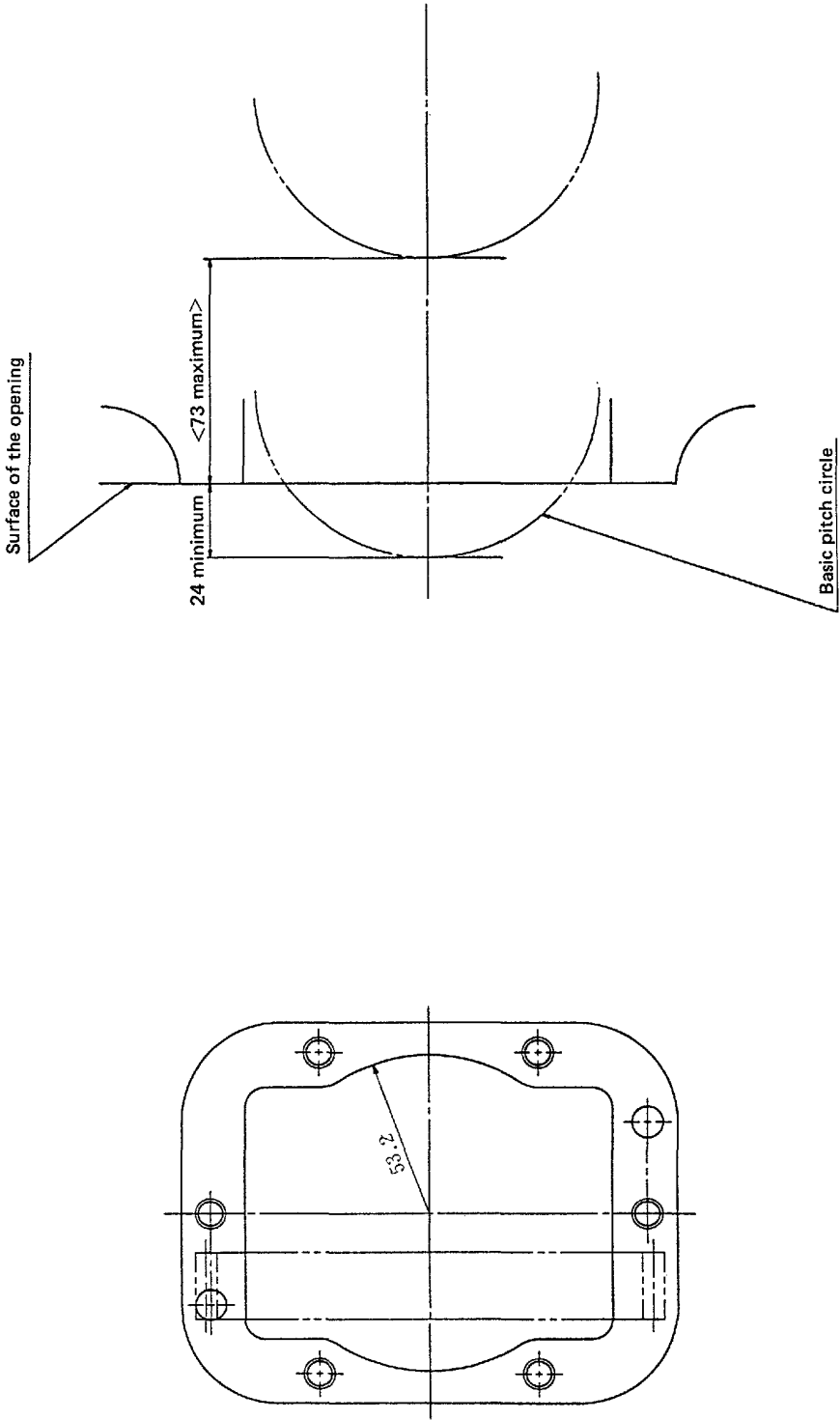
- (1) In July 1961, a request for the preparation of draft was proposed by body manufacturers in a joint meeting of both chassis and body manufacturers.
- (2) In December 1963, a policy was framed

to proceed the plan concretely by establishing the Power Take-off Technical Committee.

- (3) In February 1964, three kinds of original drafts were prepared according to the chassis size from the viewpoint of special equipment vehicles by the body manufacturers. Because it was unknown to what extent the plan could be applied to the chassis manufacturer, the original draft was prepared with the intention to proceed the discussion on the draft in which the concept of body manufacturers was fully incorporated by referring to SAE, BNA standards and the present statistical values of chassis under production in Japan. However, various problems were raised on the transmission design from the chassis manufacturers' side, resulted in significant discrepancy from the original draft.
- (4) In March 1964, it was studied to what extent the original draft prepared by the body manufacturers' side could be accepted by the chassis manufacturers' side. For the above, the working group was organized by the chassis manufacturers was determined.
- (5) In April 1964, based on the above, the draft revised only by the body manufacturers' side was prepared and submitted again to the Technical Committee in May.
- (6) In May 1964, the deliberation was conducted more concretely. After deliberating and reviewing carefully, the definite plan was completed in May 1965. During this deliberation, the discussion was focused on whether torque value should be included in the standard, what torque value should be taken and also how to determine the size of opening.
- (7) In the process of deliberation, indistinct points about the SAE standard and the present state of PTO in USA were inquired to the executive office of SAE at the end of 1964. The state of PTO and special equipment vehicles in other foreign countries was also investigated. The results of the above were taken into consideration for discussion.

Attached fig. 1-2 For standard type (type S2)
type A and type B

Unit: mm



Remarks 1: Counterpart gear of PTO may be positioned on the imaginary line.
2: Wider take off opening is shown for type S2.
3: Figs. within < > show dimension for the type B.

Course of re-examination

The original draft was reviewed for the first time from November 1965 to March 1966, and the torque value for heavy duty PTO was revised. Although there was intense opinion that the size of Type B for light loading was too small for the PTO to which the normal torque of 150 N·m was applied, the revision was unaccepted from the viewpoint that the problem came mainly from the difficulty of PTO design for the chassis of which surrounding conditions were restricted such as for PTO and the passing-through route of output shaft, etc., and was not necessarily denying the adequacy of opening size itself for the power take-off.

The second time re-examination was done from July 1972 to February 1973. Considering the present condition that the **explanatory notes** in addition to the stipulations in the main articles of this standard were performing as the technical guide regarding PTO, the contents of tables and the matters related to the application of PTO and reduction ratios, etc. in the **explanatory description** in 2.2 of the **explanatory notes** were revised by reflecting the present use conditions of PTO which had been diversifying in recent years. Moreover, the terms in English of the standard titles, etc. were partly changed. In addition, suggestions to enlarge the opening size, bolt size, etc. from the viewpoint of flexibility in the design of seal of fitting surface and PTO was proposed by the members of body manufacturer's committee for Type B light loading. It was decided to remain these matters as existing because it was considered that there were methods to deal with either of these problems technically at present, and the appropriateness for making the size larger was not acknowledged, considering that it was unfavorable to make the opening size larger for the small type transmissions to which the opening size for light loading was to be applied.

This standard was re-examined for the third time from April to December in 1990. Such matters to be considered as the problems when ISO Standard was reflected (investigation of use conditions by chassis manufacturers) and the switching-over to SI unit were discussed. Finally, it was decided to adopt ISO Standard, to add one more type in order to cope with the appearance of larger side openings for heavy duty vehicles and to indicate the type by the vehicle size.

Purpose

This standard aims to simplify the kind of PTO opening provided at the side of transmission for automobile and to secure its proper quality.

The matters which are considered necessary for the supplement explanation are described below. (The item numbers are identical as those of **main articles** of the standard.)

1. Scope

Although there are various methods to take-off power, only those from the side of transmission is stipulated also this time.

2. Position, shape and dimensions of the take-off opening

2.1 Position of the take-off opening

There are such cases to provide the opening at the right side, left side, or both sides of transmission as the position of opening. It was established to be provided at the left side only as the present condition in order to cope with the actual condition from the investigation results of use in Japan.

2.2 Kind by loading capacity

The ISO Standard does not stipulated the kind by the torque but by the size of mounting opening, so there are two kinds. However this standard stipulates four kinds because there are special equipment vehicles of small and large size in Japan. There were many opinions whether torque was specified or not in the **main articles** when the standard was established in 1964, but on the other hand, there was also such opinion that it is better to be made as **reference matter** or to be described in **explanatory notes**, etc. because it was difficult to define torque in the strict meaning. Thus this discussion was not settled down easily. However a definition was proposed by the committee members of body manufacturers' side that "the maximum normal torque is the maximum torque which is repeated normally and instantaneously input torque of within 30% of the above is to be added." Its value was decided as same as the original plan because the value was identical to the practically used value obtained from the data of special equipment vehicles presently used. It was also decided that the value might be reviewed at the time of re-examination in future, if there is any inadequate point.

When the actual condition of used torque was examined at the time of re-examination in 1968, it was clarified that the rate of crane trucks of which torque value exceeded the standard value of 200 N·m for heavy loading had increased remarkably.

Therefore, it was decided to include this value in the scope of the standard, and the torque value was raised up to 340 N·m which was considered to be the upper limit. The torque value for vehicles of which weight was 2 ton or less, is was decided to be 100 N·m at the first time, but as for the torque value of 150 N·m, it was unified with 100 N·m to simplify the standard. When the engine is too small and the full torque does not reach this value, the value which corresponds to the engine may be used.

As the results of investigation for actual conditions at the time of re-examination in 1990, it was found that the loading capacity was not determined by the size of opening for PTO, so the indication of loading capacity was deleted from the **main articles**. However, as there was such opinion that the indication of loading capacity was necessary for guidance, it was transferred to the **explanatory notes**. The results are summarized in **Explanatory notes table 1** as follows.

In addition, from the viewpoint of the use condition of power, it is preferable that the transmission is constructed so that the reduction gear ratio specified in the range of **Explanatory notes table 2** can be obtained.

In the **Explanatory table 2**, standard values and allowable values were designated in the column of reduction gear ratio at first, but such expression was abolished by the following reason. That is, with the diversification of PTO application in recent years, the actual state was that it was preferable to adopt the reduction gear ratios of low values for tank lorry, dust truck, crane truck, etc., which were continuously used, and to adopt the reduction gear ratios of high values for dump truck, etc. in the range of reduction gear ratios indicated in **Explanatory notes table 2**. The title of this column was expressed as "transmission ratio" at first, but it was changed as "reduction gear ratio" in connection with the terms used in JIS. In addition, the object chassis was changed also from the consideration of actual state.

Explanatory notes table 1

Unit: mm

Classification	Shape, dimensions and nominal dimensions of power take-off opening	(Reference) Loading capacity
For regular vehicle	117.4 x 82.4	250 N·m and under
For large vehicle	160 x 120 184.2 x 127 210 x 120	Over 250 N·m

Explanatory notes table 2

Specifications	Speed of output shaft of PTO	Reduction gear ratio	Speed of engine	Object chassis
	RPM	Engine PTO	rpm	
Classification				
For regular vehicle	700 ~ 1000	2.0 ~ 1.4	1400	Vehicle of 2 to 3 ton weight
For large vehicle		1.7 ~ 1.2	1200	Vehicle of 3 to 7 ton weight
		1.4 ~ 1.0	1000	Vehicle of over 7 ton weight

2.3 Kind of PTO by the position of gear to be engaged

Although it was desired by PTO manufacturers to unify the kind only to one kind of type A, it was decided to adopt two kinds because it was difficult from the construction of transmission. Type A corresponds mainly to the method to take off the power from the reverse idler. Type B corresponds mainly to the method to take off the power from the counter gear, and is most frequently used for the chassis presently used. In the attached **figs. of main articels**, it is draw on the plane perpendicular to the opening surface, but it is allowed that the plane is inclined to the opening surface.

2.4 Shape and dimensions of power take-offs

(1) Dimensions of power take-offs

From the result of investigation of actual use condition at the chassis manufacturers at the time of re-examination in 1990, it was found that there was no PTO of which size was coincided with the standard strictly, or was conformity with ISO Standard. Therefore, this standard was matched with ISO Standard under the condition that this standard should be applied at the time of new design.

However, it was decided to establish 3 kinds of PTO types for large vehicles based on the actual state. (The PTO for heavy-duty specified by ISO is only one kind.)

(2) Position of gear to be engaged with PTO in up-and-down direction

Because it is possible to place the gear at the center of opening with consideration to incline the opening surface, the position is taken at the center of opening as the standard.

(3) Position of gear to be engaged with PTO in front-and-rear direction

It was decided that the gear position is allowed to be either position of front or rear within the range of absolute value of offset because it was not adequate for the PTO to place at the center, and also not adequate for the transmission to place at the front or rear. This offset value was determined by the bearing part of the idle gear shaft of PTO and the space for gear shift amount for Type B. For Type A, the offset value was

made larger than Type B to utilize the opening width effectively with consideration to the case where the both of duplex reverse idler gears of transmission projected from the opening surface.

(4) Distance between the standard pitch circle of gear to be engaged with PTO and opening surface

If the projected amount of Type A is too little, the design of PTO becomes impossible and the universal joint may be interfered with the transmission case, therefore the minimum value was determined. On the other hand, in the case of Type B, the maximum value was determined because the outside diameter of idle gear might interfere with the transmission case or the output shaft of PTO might access too close to the transmission case side if the retracted amount was too large. In addition within the range of retracted amount of a certain depth, the idle gear shaft might interfere with the flange surface of PTO case. It is preferable to consider to avoid this range in the PTO design.

(5) Holes for fixing bolts

Because there is a case of 1.25 as the screw pitch for the screws of M10 and M12, the standard specified in two ways. However it is preferable to use the screw pitches of 1.5 for M10 and 1.75 for M12 threads as far as possible. Although there was such opinion that it was better not to specify the bolt holes for positioning as the standard, it was decided to be better to specify them from the viewpoint of maintaining the accuracy. The results of above-mentioned matters are summarized in **Explanatory notes table 3**.

Explanatory notes table 3

	Before revision OF JASO (E 001-73)	Revised JASO standard (C 205-91)	ISO standard (7804-85)
For regular vehicle	95 x 65 (M8) 120 x 85 (M10)	*1 117.4 x 82.4 (M10)	117.4 x 82.4 (M10)
For large vehicle	160 x 120 (M10)	*2 160 x 120 (M10) *3 184.2 x 127 (M12)	184.2 x 127 (M12)
*1. Unif		*4 210 x 120 (M12)	

*1. Unified with ISO Standard (7804-85)

*2. Same as JASO Standard (E 001-73)

*3. Introduced ISO Standard (7804-85)

*4. Established as JASO Standard (C 205-91)

2.5 Gears to be engaged with PTO for exclusive use

As the result of discussion at the re-examination in 1990 whether this item is to be left in **main articles**, it was decided to delete it from **main articles** and to transfer to **explanatory notes**, referring to ISO Standard. From the aspect of manufacturing side of PTO, it is preferable to adopt the standard gear profile, but it can not be standardized. Therefore, when using a gear of special tooth profile, it is preferable to install the gear for exclusive use at the transmission side as possible. Here the special tooth profile means the tooth profile generated by the cutter having no marketability.

Gear to be engaged with PTO for exclusive use

When using a gear for exclusive use, it shall be adopted according to **Explanatory notes table 4**.

Explanatory notes table 4

Classification	For regular vehicle	For large vehicle
Specifications		
Module	3	4 or 4.5
Tooth pressure angle	20°	
Kind of gear	Spur gear	

In the event of any doubt, the original standards in Japanese should be referred.

SI : THIRD PHASED STANDARD

(The standard where SI units and newly values are given and do not using customary units, but it is excepted that the standards are represented in only accustomed metric units as m, A, Hz etc.)

Established by the Standard Council of JSAE

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Technical Committee under which the draft was discussed : TC of Chassis

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