Profile projectors

Introduction This Standard is the original Japanese Industrial Standard and does not correspond to any International Standard.

1 Scope This Standard specifies profile projectors that measure length, angle, profile and so forth. The profile projector consists of the project lens, the screen, the lighting equipment, the stage or the precise cross-moving table, and the main body that supports these (see Attached Table 1, Attached Table 2 and Attached Table 3).

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards indicated below shall be applied.

JIS B 7181 *Resolving power test charts for projection lens*

JIS B 7526 *Squares*

JIS B 7536 *Electrical comparators*

JIS B 7541 *Standard scales*

JIS R 6001 *Bonded abrasive grain sizes*

3 Definitions For the purposes of this Standard, the following definitions of main terms shall apply.

a) ***X* axis** The axis of the precise cross-moving table that moves in the lateral direction on the projection surface.

b) ***Y* axis** The axis of the precise cross-moving table that moves in the direction perpendicular to *Y* axis on the projection surface.

c) **measuring accuracy** Accuracy obtained when a profile projector measures measurement standard under the actual measurement condition.

4 Performances The performances shall be as shown in Table 1 provided that tolerance shall be at 20 °C.

5 Marking On the main body of the profile projector, manufacturer's name or abbreviation and manufacturing number shall be marked, and on the projection lens, the nominal magnification.

Table 1 Performances

No.	Item		Measuring method	Explanatory drawing	Measuring tool	Tolerance
1	Squareness between the X axis direction of movement and the Y axis direction of movement, of the table		Place the using surface of the square on the top surface of the table parallel with the X axis direction of movement, and then obtain the maximum value of the indicated run-out when making the table move in the Y axis direction, applying the electric comparator or the like which is fixed at the place where the projection lens is mounted, to the other using surface of the square.	Attached Fig. 4	Squares (type I, grade 1 in accordance with **JIS B 7526**) or tools having equivalent performance. Electric comparators (in accordance with **JIS B 7536**) or tools having equivalent performance.	$(4.5 + 0.06\ L)$ μm max. where, L: Travel amount (mm) of the table, to apply over the entire measuring range.
2	Magnification accuracy when using transmission lighting of projection lens	X axis direction	Place the standard scale on the top surface of the table, and measure the projected image by using the standard scale for reading with the centre of the screen* being taken as the original point. Express the error of magnification between the magnification measured and the nominal magnification in percentage.		Standard scales (grade 01 in accordance with **JIS B 7541** or standard scales calibrated with accuracy of 1 μm) or tools having equivalent performance. Standard scales for reading (grade 3 in accordance with **JIS B 7541**) or tools having equivalent performance.	± 0.15 % of nominal magnification
		Y axis direction				

Note * In the case where the projection surface is a transparent screen, a suitable transmission diffusing screen shall be placed.

Table 1 (continued)

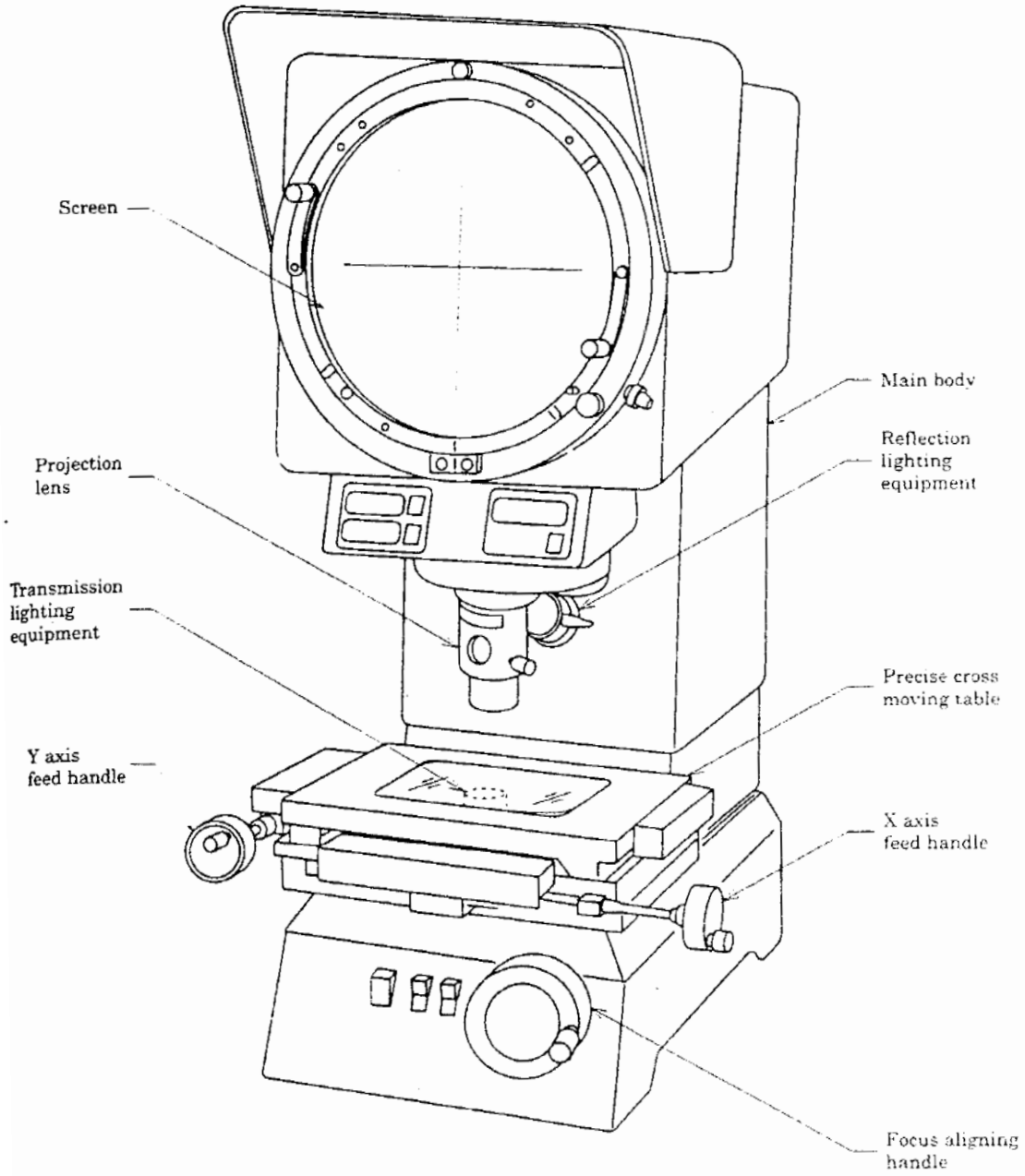
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Measuring method</th><th>Explanatory drawing</th><th>Measuring tool</th><th>Tolerance</th></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Magnification accuracy when using reflection lighting of projection lens</td><td>X axis direction</td><td rowspan="2">Place the standard scale on the top surface of the table, and measure the projected image by using the standard scale for reading with the centre of the screen* being taken as the original point. Express the error of magnification between the magnification measured and the nominal magnification in percentage.
Then, insert the diffuser between the transmission lighting equipment and the standard scale at a position 20 mm away from the standard scale and lighting shall be carried out by diffusing light. Further, for the projector having semi-transmission mirror, the measurement shall be carried out with it attached.</td><td rowspan="2">Attached Fig. 5</td><td rowspan="2">Standard scales (grade 01 in accordance with JIS B 7541 or standard scales calibrated with accuracy of 1 μm) or tools having equivalent performance.
Standard scales for reading (grade 3 in accordance with JIS B 7541) or tools having equivalent performance.
Diffuser (the plate glass sand-ground by using abrasives of grain size #800 in accordance with JIS R 6001).</td><td rowspan="2">± 0.25 % of nominal magnification</td></tr>
<tr><td>Y axis direction</td></tr>
<tr><td>4</td><td colspan="2">Resolution limit when using transmission lighting of projection lens (excluding relay lens style projectors)</td><td>Place the resolving power test chart on the top surface of the table and carry out the focus aligning so that the clearest image can be obtained at the centre of the screen* and determine the minimum recognizable chart value as the measured value. The direction of chart shall be determined so that one direction of the stripe becomes the radiation direction viewing from the centre of visual field.</td><td></td><td>Resolving power test charts (in accordance with JIS B 7181) or tools having equivalent performance.</td><td>Unit: number/mm
<table>
<tr><th>Magnification (min.)</th><th>Centre</th><th>Within 2/3</th><th>Others</th></tr>
<tr><td>5×</td><td>40</td><td>25</td><td>16</td></tr>
<tr><td>10×</td><td>80</td><td>50</td><td>32</td></tr>
<tr><td>20×</td><td>100</td><td>80</td><td>50</td></tr>
<tr><td>50×</td><td>160</td><td>125</td><td>80</td></tr>
<tr><td>100×</td><td>250</td><td>200</td><td>125</td></tr>
</table></td></tr>
</table>

Table 1 (continued)

No.	Item	Measuring method	Explanatory drawing	Measuring tool	Tolerance
5	Resolution limit when using reflection lighting of projection lens (excluding relay lens style projectors)	Place the resolving power test chart on the top surface of the table and carry out the focus aligning so that the clearest image can be obtained at the centre of the screen* and determine the minimum recognizable chart value as the measured value. The direction of chart shall be determined so that one direction of the stripe becomes the radiation direction viewing from the centre of visual field. Then, insert the diffuser between the transmission lighting equipment and the chart at a position 20 mm away from the chart and lighting shall be carried out by diffusing light. Further, for the projector having semi-transmission mirror, the measurement shall be carried out with it attached.	Attached Fig. 5	Resolving power test charts (in accordance with **JIS B 7181**) or tools having equivalent performance. Diffuser (the plate glass sand-ground by using abrasives of grain size #800 in accordance with **JIS R 6001**).	Unit: number/mm Magnification (min.) / Centre / Within 2/3 / Others 5× / 20 / 16 / 13 10× / 32 / 20 / 16 20× / 50 / 32 / 25 50× / 125 / 100 / 63 100× / 200 / 160 / 100
6	Concentricity of rotating screen cross wire about rotating centre	Place the mark such as cross wire on the top surface of the table and project it on the rotating screen, and then rotate the rotating screen. Read the amount of displacement of the rotating screen cross wire during rotation.	Attached Fig. 6	Cross wire chart, etc.	0.3 mm max.

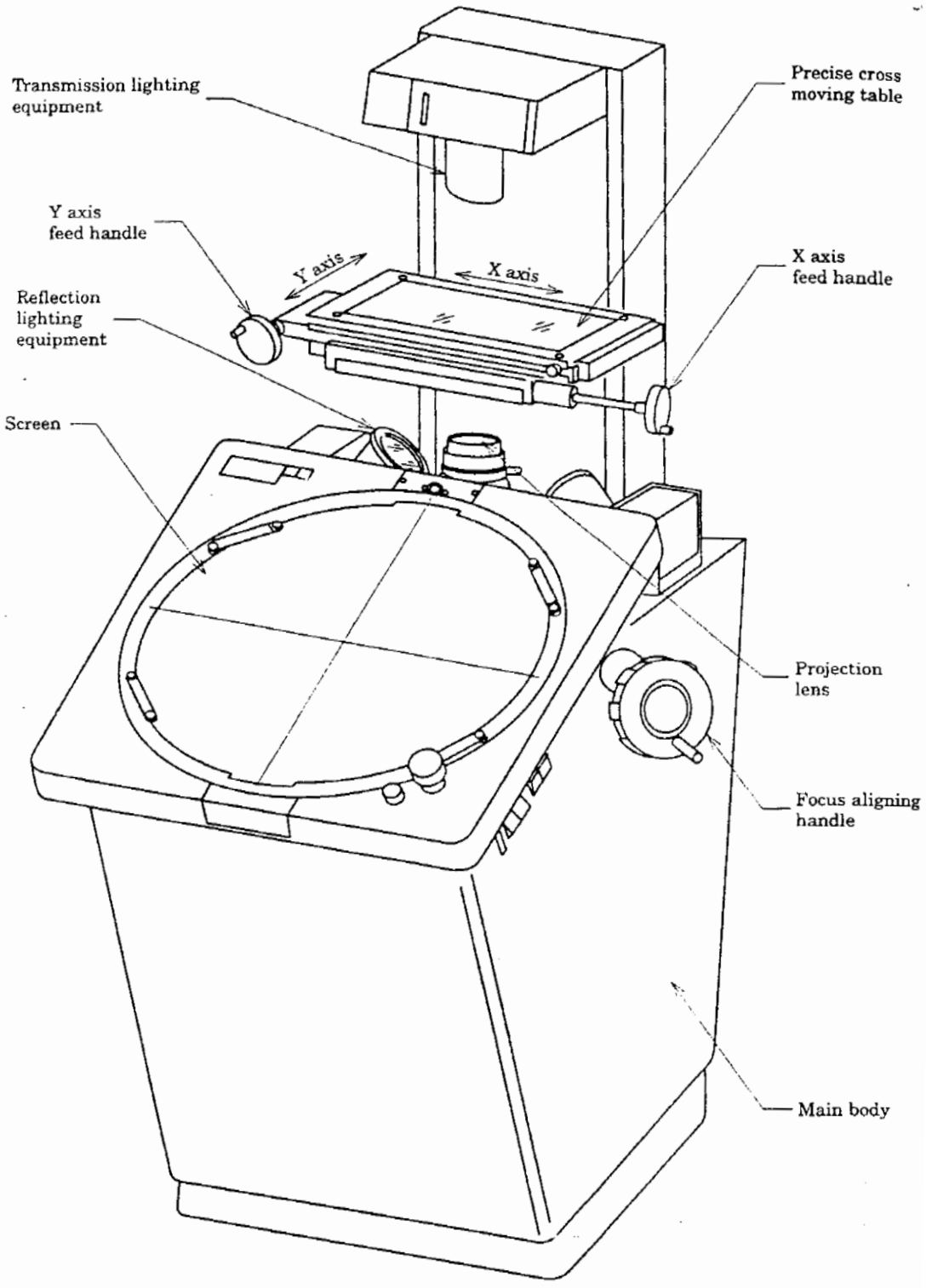
Table 1 (concluded)

No.	Item		Measuring method	Explanatory drawing	Measuring tool	Tolerance
7	Measuring accuracy of rotation angle of rotating screen		Place the cross wire chart on the top surface of the table and project it on the rotating screen, and obtain the maximum difference of the error by measuring the rotation angle using the rotating screen.	Attached Fig. 7	Cross wire chart of 90° calibrated at 30″ max.	4′ max.
8	Measuring accuracy of each axis	*X* axis direction	Place the standard scale on the central part of the top surface of the table parallel with the direction of movement, and move the table while measuring it by the profile projector. Obtain the difference between reading of the profile projector and the moved length of the standard scale over the entire measuring range and the maximum opening within the interval (L) between any two points.	Attached Fig. 8	Standard scales (grade 01 in accordance with **JIS B 7541** or standard scales calibrated with 1 μm accuracy) or tools having equivalent performance.	$\lvert 6 + 0.04\,L \rvert$ μm max. in each direction: where, L: measuring length (mm), to apply over the entire measuring range.
		Y axis direction				
9	Image travel by magnification conversion		Place the mark such as cross wire on the top of the table, and make it coincide with the centre of the screen by using the projection lens having the maximum magnification employed in the profile projector, and then obtain the travel amount of the mark by changing the magnification using any projection lens or by carrying out zooming operation.		Cross wire chart, etc.	0.5 mm max. on the body surface
10	Angle accuracy of screen cross wire		Place the cross wire chart on the top of the table and project it on the screen. Obtain the displacement of angle to the screen cross wire.	Attached Fig. 9	Cross wire chart of 90° calibrated at 30″ max.	90° ± 2′ max.



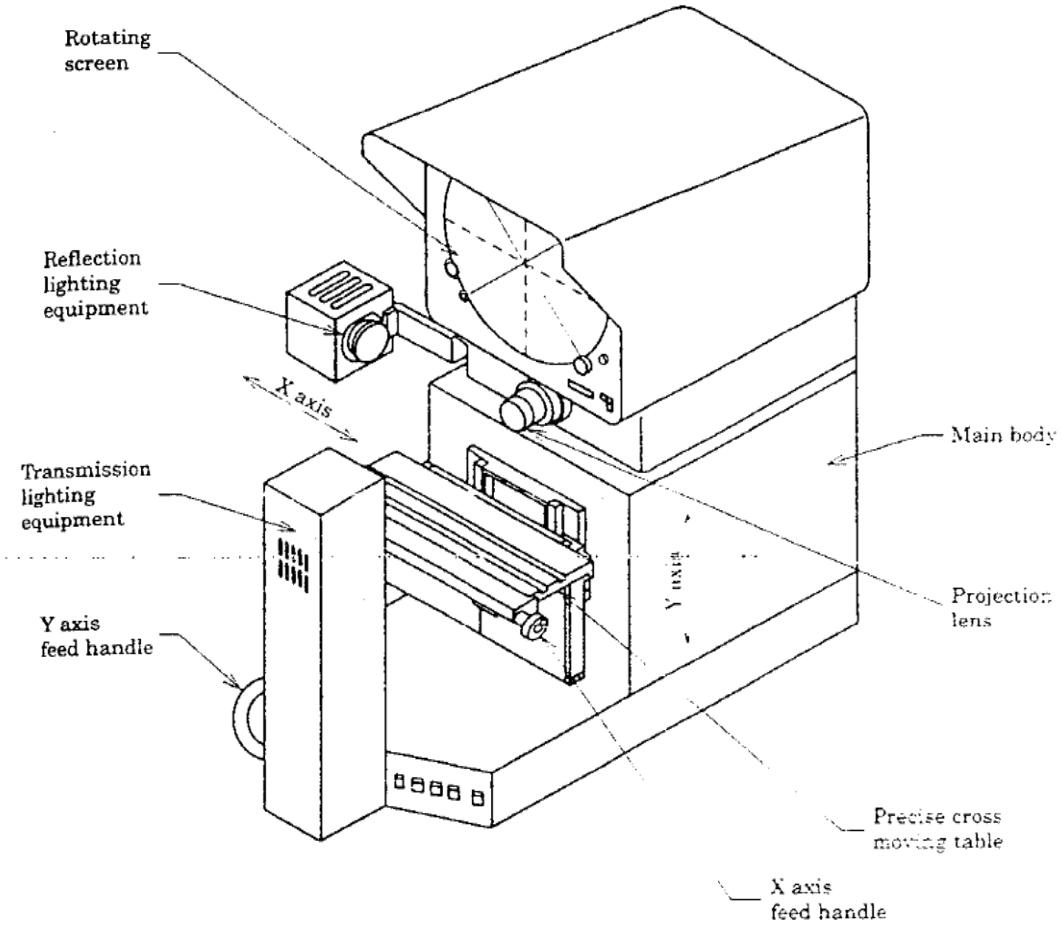
Remarks : This figure shows an explanatory drawing and does not indicate structure or shape.

Attached Fig. 1 Vertical type profile projector optical axis upward type



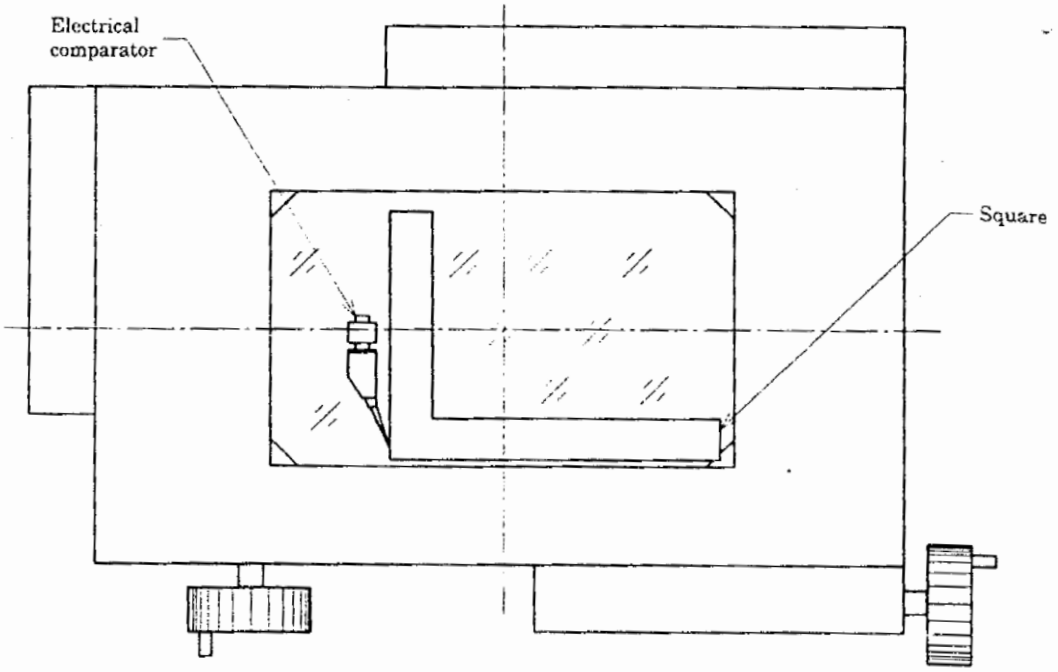
Remarks : This figure shows an explanatory drawing and does not indicate structure or shape.

Attached Fig. 2 Vertical type profile projector optical axis downward type

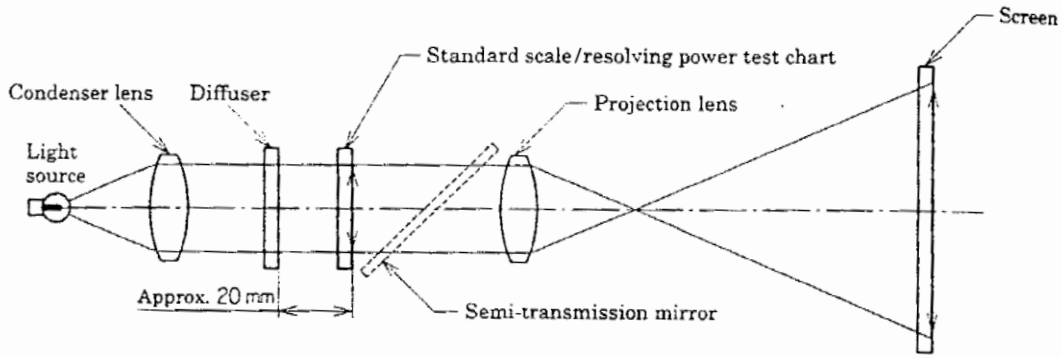


Remarks : This figure shows an explanatory drawing and does not indicate structure or shape.

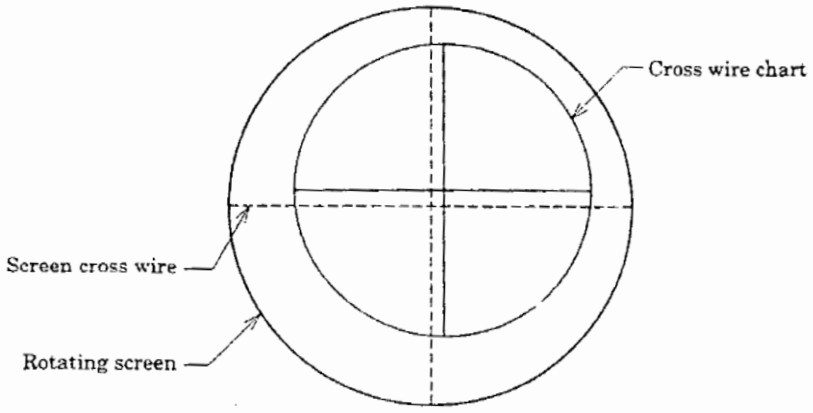
Attached Fig. 3 Horizontal type profile projector optical axis lateral type



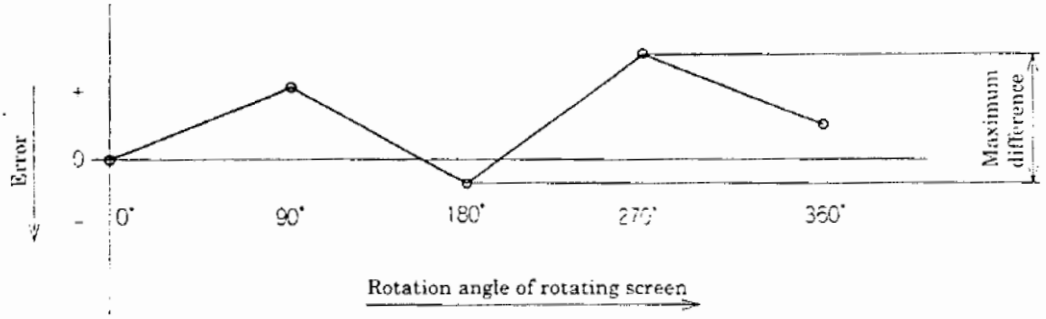
Attached Fig. 4 Measurement of squareness



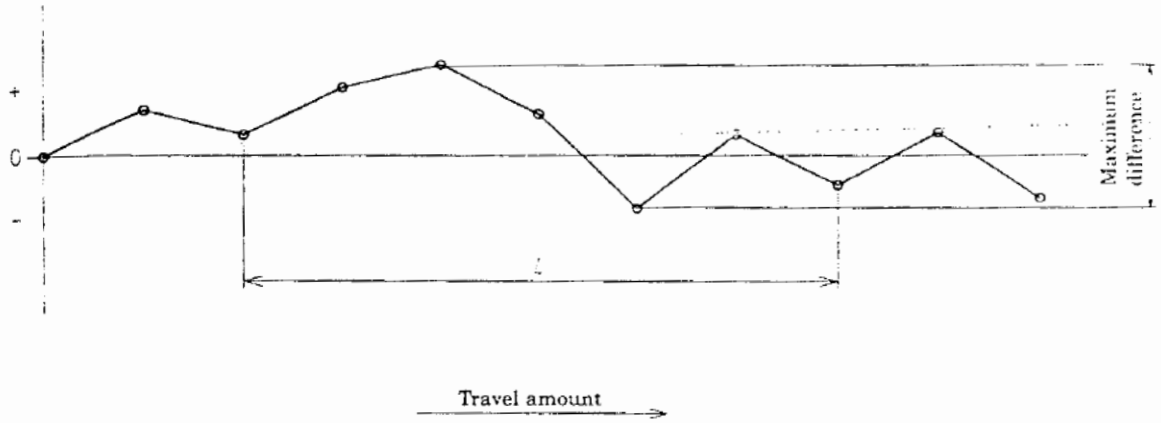
Attached Fig. 5 Measurement of magnification accuracy and resolution limit



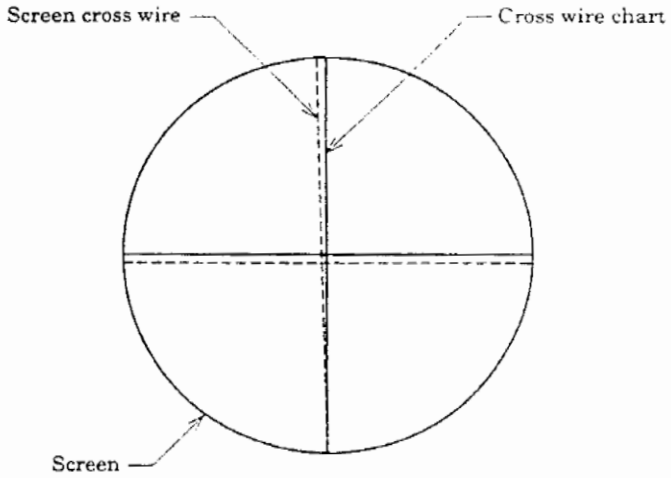
Attached Fig. 6 Measurement of cross wire concentricity



Attached Fig. 7 Measurement of rotation angle



Attached Fig. 8 Measuring accuracy of each axis



Attached Fig. 9 Measurement of angle accuracy of cross wire