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PRECIPITATION GAUGES AND RECORDERS

- Rain and Snow Gauges
- Mechanical Rain Recorders



Rain and Snow Gauges

The **Rain-Gauge 69d** (fig.1) consists of a double layer cylindrical upper part, serving as receiver, whose aperture forms the receiving area as well as a lower part with the collecting can. The rain which falls through the aperture is led into the inner collecting can via a funnel.

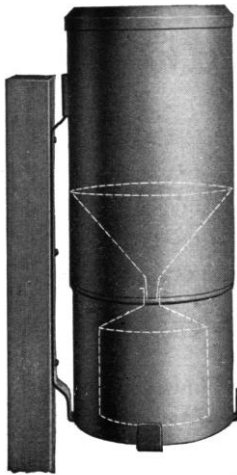


Fig. 1 Rain Gauge 69d
with holder on a bar



A special construction of the funnel mounting, optimised by the company Dr. Müller Meteorologische Instrumente KG avoid the stop of waterdrops on the inner sides of the upper part. To avoid an extreme evaporation of the collected rain water in the collecting can, the latter is set up free all round, so that a direct heat conduction from the radiated casing to the collecting can is prevented by the surrounding air.



The **Rain- and Snow Gauge 69** differs from the prescribed type only in that way, that all parts as upper part, lower part, collecting can and snow cross, necessary for transformation of snow in the form of liquid water, are presented twice. The time required for the melting process is not lost therefore for continuous receiving of precipitation. In the case of snowfall the snow cross has to be put into the upper part to prevent whirling out of the snow by influence of the wind.

In order to measure the height of rainfall, one takes the upper part from the hook, removes the collecting can from the lower part and empties the same into the measuring cylinder. The height of precipitation in mm rainfall is read off directly on the scale of the measuring cylinder; the scale is graduated from 0 to 10 mm of rainfall in intervals of 0.1 mm.

In the case of type 69 the observer exchanges the whole instrument after snowfall against an empty one. Then the snowfilled rain gauge is closed by the cover and taken into a warmer room. After melting the snow, the height of the melted snow may be determined by means of the measuring cylinder.

Both types of instruments should expediently be mounted on plane terrain in such a way that the distance away from every surrounding object should be not less than twice the height of the object. This applies especially to the weatherside. The Rain Gauge is screwed by means of pertaining holder to a post in such a way that the receiving area lies horizontally and 1 m above the ground.

In the case of unstable weather, there exists the possibility that a drift of atmospheric precipitation, as it may present itself at the casing's jacket by formation of a whirl, may lead to a deficit of the collected quantity of precipitation, as compared to the actually fallen quantity. Such errors in measurement can be avoided with the aid of wind shield 69w according to Woelfle, which consists of a shield of 840 mm diameter with 16 elastic blades. A joint support carries instrument and wind shield, with four stays orientating the latter towards the receiving area. The whole equipment is fastened to a tubic support of approximately 75 mm diameter which, itself, however, is not part of the delivery, in general.

Specifications

- 69d** Rain Gauge, Hellmann type
with receiving area of 200 cm²,
made of stainless steel 316 L - 1.4404 and 316 - 1.4401
according to the requirements of the German meteorological service and WMO standard
consisting of:
1 upper part with receiving ring (Ø = 17.8 cm; h = 29.5 cm; Ø of receiving ring = 15.9 cm)
1 lower part (Ø = 17.6 cm; h = 19.0 cm)
1 collecting can No. 69t (Ø = 11.8 cm; h = 16.0 cm)
1 support No. 69v
1 measuring cylinder No. RM25 T171
for raingauge with 200 cm² receiving area
corresponding 10 mm of rainfall
divisioned in 0.1 mm rainfall
according DIN 58667B
made from Polystyrol
Dimensions: 178 mm diameter x 447 mm height.
Weight: 3.5 kg
- 69** Rain and Snow Gauge, Hellmann type
with receiving area of 200 cm²
consisting of:
2 upper parts with receiving ring
2 lower parts
2 collecting cans No. 69t
1 support No. 69v
1 measuring cylinder No. RM25 T171
2 snow crosses No. 69u
1 protective cover
Dimensions: 178 mm diameter x 447 mm height, each

Supplementary and spare parts

- Rm25 T171** Measuring cylinder
for raingauge with 200 cm² receiving area,
for 10 mm rainfall,
divisioned in 0.1 mm of rainfall,
according DIN 58667B,
made from Polystyrol



- 69t** Collecting can, capacity 1.4.
- 69u** Snow cross.
- 69v** Holder for suspension of rain gauge.

Mechanical Rain Recorders

Whilst simple rain gauges and rain recorders, solely, indicate the total quantity of precipitation during the period of observation, the structure of rainfall is to be seen additionally from the diagram of a rain recorder; i. e., the timely division, intensity, etc. An example as to the relation of these values indicates table 1, which shows how the average number of yearly rainfall decreases with increasing intensity and duration.

Fig. 3 Measuring Principle of Mechanical Rain Recorder 95.

- A aperture ring
- B float vessel
- C float
- D casing
- H siphon
- K collecting vessel
- Z pen arm

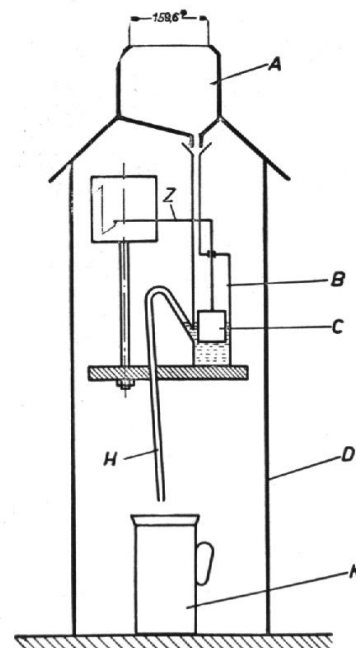


Table 1. Intensity, duration, and frequency of rainfall in Kempten, Allgäu, during an observation period of 23 years, as acc. to Haeuser, J.: "Abhandlung der Bayrischen Landesstelle für Gewässerkunde", München, 1919 (Treatise of the State Institute of Hydrology for Bavaria, Munich). The mean yearly quantity of precipitation in Kempten amounts to appr. 1470 mm.

Intensity of Rainfall																			
mm of Rainfall per min ≥	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1,0	1,2	1,4	1,6	1,8	2,0	2,6	3,0	3,4	
Litres per Hektar and sec ≤	17	35	52	68	85	1,2	118	135	152	168	202	235	268	302	335	435	502	568	
Duration of Rainfall	Average Number of Rainfalls during a Year's Time																		
1...5 min	-	16,9	12,6	9,6	7,4	6,0	4,7	4,1	3,4	2,7	1,9	1,2	1,0	0,6	0,3	0,13	0,09	0,04	
6...10 min	-	12,0	7,8	4,9	3,9	3,0	2,4	1,7	1,3	0,7	0,5	0,3	0,2	0,1	0,1	-	-	-	
11...20 min	-	8,1	4,4	2,8	2,0	1,4	1,0	0,6	0,5	0,4	0,3	0,2	0,1	0,04	-	-	-	-	
21...30 min	11,1	3,3	1,8	1,7	0,9	0,4	0,4	0,4	0,3	0,2	0,04	-	-	-	-	-	-	-	
31...45 min	9,0	2,3	1,3	0,7	0,5	0,2	0,2	0,1	-	-	-	-	-	-	-	-	-	-	
46...60 min	5,2	1,1	0,7	0,4	0,2	-	-	-	-	-	-	-	-	-	-	-	-	-	
1...2 hrs	2,9	0,9	0,4	0,13	0,1	-	-	-	-	-	-	-	-	-	-	-	-	-	
2...3 hrs	0,9	0,3	0,04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Over 3 hrs	0,5	0,13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Three types of mechanical rain recorders are available for the different fields of application. When making one's choice, one is always to consider the goal of measurement. Thus, for instance, one will be able to dispense, in climatological investigation, with the optimum of resolution of heavy rains which, already, present themselves only seldom, and which are of short duration. For the sewerage engineer, on the other hand, these extremes are of special importance; e. g., for dimensioning the cross section of conduits, etc.

The Mechanical Rain Recorders 95, 95y, and 95c, differ from one another in the essential by height and kind of recording. The measuring system is constructed in a similar way, in the case of all these types. As is shown in fig. 3, the round casing D carries above a sharp-edged aperture ring A, which, normally, limits the receiving area to 200 cm². The fallen-in rain flows into the cylindrical float vessel B, lifting the float C. The motion of this latter is transmitted to the pen by means of a float rod carrying the pen arm Z.

There results, thus, a trace on the diagram paper moving evenly under the pen, the more or less steep ascent of which corresponds to the momentary intensity of rainfall (fig. 4). At a certain fallen-in quantity of rain, the pen has reached the maximum value of the range. Via a correspondingly adjusted siphon H, the float vessel B is, now, being emptied within the shortest possible time, the pen arm returns to its zero-position, and the process may start, anew.

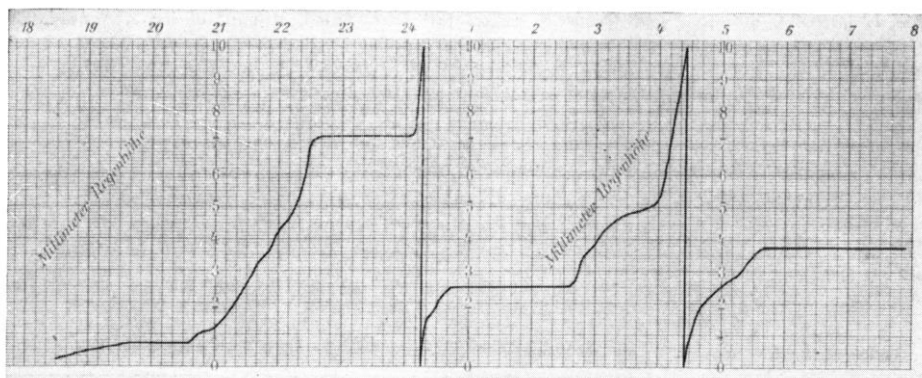


Fig. 4 Part of an original Recording of Mechanical Rain Recorder 95.
One half of natural size
(chart No. 2, for daily rotation)

The diagram may be evaluated at will; i. e., corresponding to the respective factors, which are of interest. An additional control of the recording is possible, also, as the water, which has flown out through siphon H, is in collecting vessel K and, therefore, the total quantity of precipitation may be determined by means of a measuring cylinder

Each siphoning of the float vessel is marked on the chart by a vertical interruption. If one takes as a basis that a distance of these verticals of 1 mm still allows for evaluation, one will understand that the as yet resolvable maximum intensity of rainfall is depending upon the speed of recording. One is to consider this when choosing the clockwork.

Normally, all mechanical rain recorders are supplied with a receiving area of 200 cm². If one reduces the receiving area by means of an exchangeable aperture ring No. 95r to 100 cm², the maximum intensity, which may be covered, is doubled, naturally. The indications of the diagram are, then, to be multiplied by the factor 2. This supplementary item, which can be supplied additionally, on request, allows for adjustment to special local or seasonal requirements, therefore. Table 2, on page 7, is giving a survey of the technical data available by the three models and shows the different combinations by the possibilities of variation.

If one is to avoid that, in the case of temperatures below 0 °C, the apparatus is no longer ready for operation, Electric Heating device 95d can be fitted, even subsequently, if the case may be. In the case of this device, a thermostat controls the switch of the two incorporated electric bulbs so that temperature within the casing is kept at an approximately constant value above the freezing point. Switching temperature is adjustable on a scale. If the heating device is used, it is recommendable, however, to provide the rain recorder with an additional wooden cabinet, as, otherwise, the loss of warmth will be rather large.

Rain Recorder 95, Hellmann Type (Standard Model)

An illustration of this model, with drum recording, shows the cover picture, and the pattern of a chart, fig. 4. Effective recording height is 78 mm for 10 mm of rainfall. Recording is effected, therefore, appr. eight times enlarged.

In the case of the usual daily rotation, the vertical lines of the recording lie, even at the high and rare intensity of rainfall for Central Europe of 2.7 mm/min, at a distance of 1 mm from each other so that these heavy rains, too, are still resolved well. A clockwork for a rotation period of 1 week can be supplied. The technical data please take from table 2.



Large Rain Recorder 95y

This instrument differs from model 95 in the essential by twice as large values of drum diameter, float vessel section, and effective recording height. By these measures, resolution of heavy rains is better by the factor 8, whilst recording is effected about four times enlarged. 40 mm of rainfall correspond to 156 mm of recording. In the case of daily rotation, intensities up to 20 mm/min are resolved. Further technical data, also for rotation periods of 1 week are shown in table 2, as well as in the specifications.

Rain Recorder 95c with Continuous Chart Recording

Utilization of this rain recorder is to be recommended when it is necessary to, quantitatively, cover precipitation over a longer period of time or to record, most accurately, the timely course.

The well-proven measuring principle has been adapted, unchanged, from Rain Recorder 95, the rotating drum, however, replaced by a continuous chart recording mechanism with hand-wound spring chart drive (resp. battery operated quartz movement). (fig. 5). Also, in the case of longer periods of recording is a large paperfeed applicable, therefore, which guarantees high evaluation even in the case of heavy rains. The continuous chart has a length of about 18 metres. By exchanging gear wheels, one may, according to choice, adjust paperfeed speeds of 5, 10 or 20 mm/h. All technical data are shown in table 2 or in the specifications.

Fig. 5 Principle of desing Rain Recorder 95c with Continuous Chart Recording.

1 aperture ring, 2 float, 3 siphon, 4 collecting vessel,
5 protective funnel, 6 drain cock, 7 continous chart,
8 casing with door

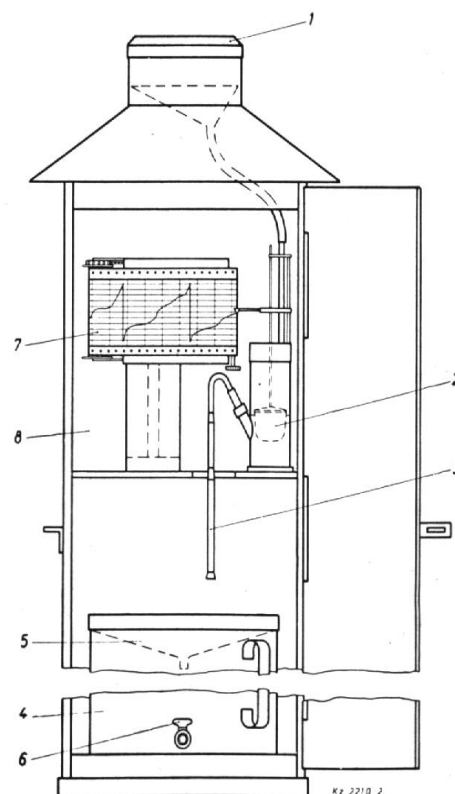


Table 2	Rain Recorder No. 95		Large Rain Recorder No. 95y		Rain Recorder No. 95c with Continuous Chart Recording		
Range per Height of Diagram (mm of rainfall)	0 to 10		0 to 40		0 to 10		
Receiving Area (cm) ²	200		200		200		
Drum Diameter (mm)	133		264		-		
Height of Recording (mm)	78		156		78		
Recording Period	"daily"	"weekly"	"daily"	"weekly"	"monthly" (standard)	"72 days"	"144 days"
Recording Period (Paper running time)	26 h	7 1/3 d	26h	7 1/3 d	36 d	72 d	144 d
Paperfeed appr. (mm/h)	16	2,3	32	4,5	20	10	5
Running Period of the chart drive	9 d	9 d	9 d	9 d	32 d	up to 1 year	up to 1 year
Maximum Intensity ¹ (mm rain/min)	2,7	0,3	20	2,7	3,3	1,7	0,8
Chart No.	2	3	2k	2i	95/20N	95/10N	95/5N
Number of Charts / Rolls per Set	100	100	100	100	10 rolls	10 rolls	10 rolls

¹ Intensity, at which the vertical lines of the diagram draw nearer to a distance of 1 mm.

Specifications

No.
95

Mechanical Rain Recorder, Hellmann Type (Standard Model) , complete, technical data as per table 2.

Recording period according to choice: "daily" or "weekly"

Dimensions: body: 240 mm, total diameter 370mm x 1000 mm height.

Weight: 11 kg

Accessories (no extra charge):

1 set of 100 pcs. of charts No. 2 resp. No. 3

1 fiber pen No. 78WF

1 measuring cylinder No. Rm25 T171,

1 collecting vessel 3,3 liter No. Rm25 UG29,

1 glass siphon No. Rm25 UG12

95y



Large Rain Recorder, complete,

technical data as per table 2.

Recording period according to choice: "daily" or "weekly"

Dimensions: body 380 mm diameter x 1000 mm height.

Weight: 28.0 kg

Accessories (no extra charge):

1 set of 100 pcs. of charts No. 2k resp. No. 2i

1 spare metal pen No. 95L with ink or 1 fiber pen 78WF (alternative)

1 measuring cylinder No. Rm25 T171,

1 collecting vessel

1 glass siphon

95c



Rain Recorder with Continuous Chart Recording,

with hand-wound spring chart drive complete,

technical data as per table 2.

Running period: 32 days with paperfeed: 20 mm/h (standard)

On special request for 72 days / 144 days

resp. 10 mm/h and 5 mm/h)

Accessories (no extra charge):

10 rolls of diagram paper No. 95/20N (resp. 95/10N or 95/5N)

1 spare metal pen No. 95L with ink or 1 fiber pen 78WF (alternative)

1 measuring cylinder No. Rm25 T171,

1 collecting vessel

1 glass siphon

Supplementary and Spare Parts for all Rain Recorders

78wf	Fiber pen
78q	metal-pen
95L	metal-pen (large size)
1095v	1 bottle of special recording ink (20 ml)
Rm25 T171	Measuring cylinder, for raingage with 200 cm ² receiving area, for 10 mm rainfall, divisioned in 0.1 mm of rainfall, according DIN 58667B, made from Polystyrol
95r	Exchangeable aperture ring for reduction of receiving area from 200 to 100 cm ² (only on special request)
95d	Electric heating device with thermostat
95dT	Thermostat for 95d
69u	Snow cross

Supplementary and Spare Parts, especially for Rain Recorder 95

ZAHNRAD 96/14	Pair of change gears for weekly rotation
ZAHNRAD 56/58	Pair of change gears for daily rotation
306d	Spare drum with clock-drive for daily rotation
306w	Spare drum with clock-drive for weekly rotation
Rm25 UG12	Glass siphon, spare. (275 mm)
Rm25 UG29	Collecting vessel, spare, capacity 3.3 liter
Rm25 UG06	Pen arm with guidance
Rm25 UG05	Float with guide rod, spare
Rm25 UG03	Float vessel with float and pen arm

Supplementary and Spare Parts, especially for Large Rain Recorder 95y

ZAHNRAD 96/14	Pair of change gears for weekly rotation
ZAHNRAD 56/58	Pair of change gears for daily rotation
307d	Spare drum with clock-drive for daily rotation
307w	Spare drum with clock-drive for weekly rotation
Rm25 UG12	Glass siphon, spare. (275 mm) - standard version
Rm25 UG10	Glass siphon, spare. (350 mm) - longer siphon
Rm4 UG29	Collecting vessel, spare, large size

Supplementary and Spare Parts, especially for Rain Recorder 95c with Continuous Chart Recording

95C-CCR	continuous chart recorder
Rm25 UG12	Glass siphon, spare. (275 mm) - standard version
Rm25 UG10	Glass siphon, spare. (350 mm) - special version
Rm25 UG11	Glass siphon, spare. (410 mm) - special version
Rm32 UG29	Collecting vessel, spare
Rm25 UG06C	Pen arm with guidance. (equipped with pen arm No. RM32 T042)
Rm25 UG05	Float with guide rod, spare.
Rm25 UG03C	Float vessel with float and pen arm. (equipped with pen arm No. RM32 T042, and special mounting position)

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