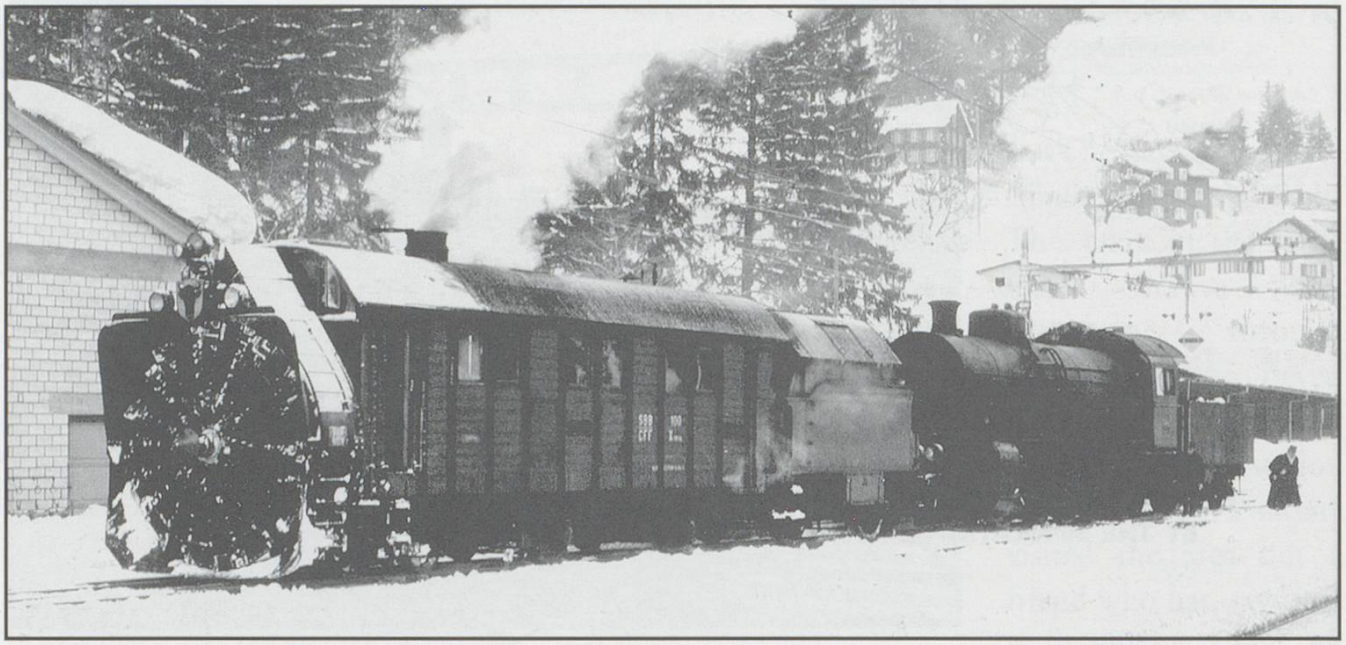
Zeitschrift: Swiss express : the Swiss Railways Society journal
Herausgeber: Swiss Railways Society
Band: - (2004)
Heft: [1]

Artikel: Clearing snow on the Gotthard
Autor: Hardy-Randall, Malcolm
DOI: https://doi.org/10.5169/seals-854770

Malcolm Hardy-Randall

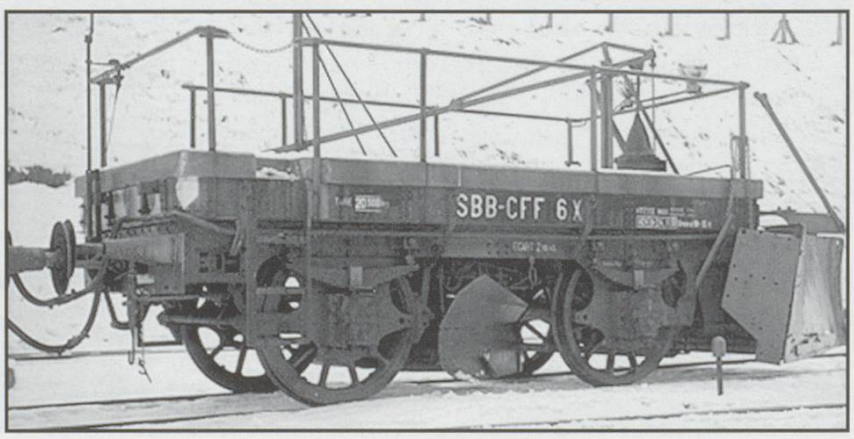
CLEARING SNOW ON THE GOTTHARD



North Ramp. Xrotd No. 100 propelled by a C5/6 locomotive awaits duty. Photo: MH-R collection

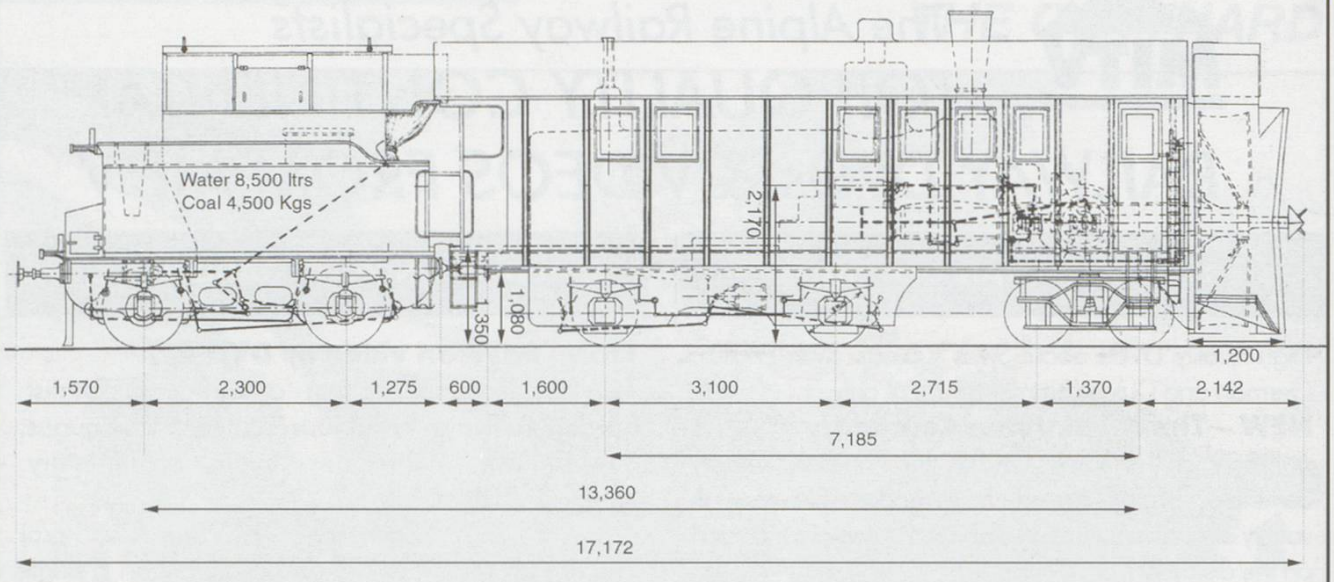
An almost constant battle is waged against the forces of nature to keep the Gotthard line open for traffic. The Swiss Federal Railway (SBB) is very much in the forefront of the fight against disruptions to traffic flow, especially those caused by snow, with many methods of preventing snow drifts and many types of snow plough, both passive and active. The SBB places great emphasis on the prevention of problems rather than curing the effects as they occur. Trees planted on the sides of the mountains provide cover for the land, not only preventing the formation of deep snowdrifts but also helping to form a barrier to the snow slide.

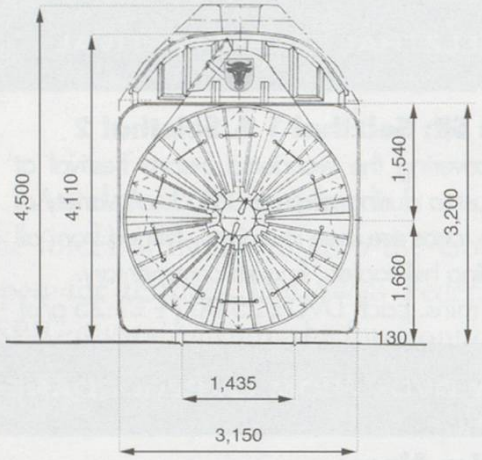
In the case of the Gotthard route many thousands of trees have been planted on the sides of the tracks, to increase the protection to the line from snow slides. Avalanche damage is often preventable in many of the areas at risk. To this end, in any area where the perceived risk is high the authorities have built large retaining fences on the sides of the mountain, to restrain the high level snow from starting an avalanche or to prevent the sliding of snow and its accumulated rubble from falling down onto the tracks below. In major avalanche risk areas the SBB has built reinforced concrete galleries to protect the line, evident in many parts of the mountain sections of the route. In the days of the Gotthardbahn (GB) for normal clearance of snow from the line a fleet of six ploughs built in 1882 were used. These units comprised a converted freight wagon with a large snow blade fitted on the front and propelled by suitable motive power.



Passive snowplough. No.6
Photo: MH-R collection

Rotary Snowplough. Type X^{rotd}





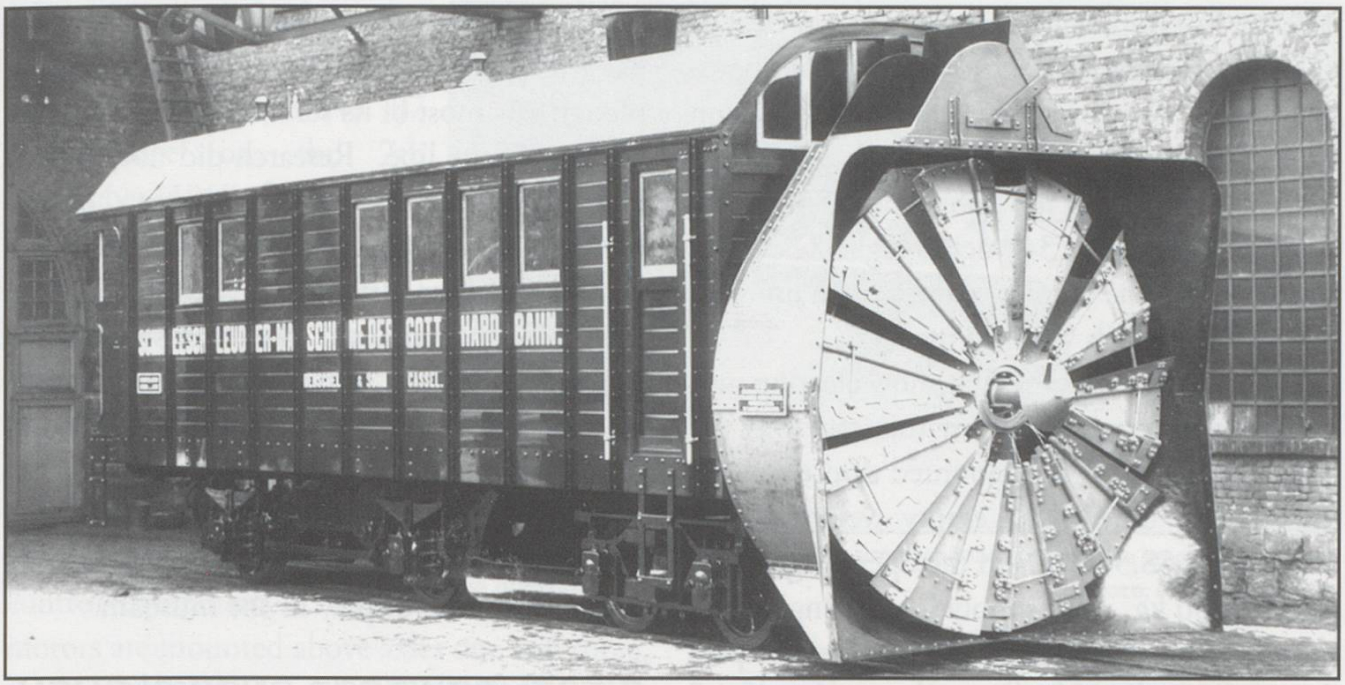
Builder	Henschel und Söhn. Cassel Germany
Built	1896
Weight Tonnes Empty	58·3
Weight Tonnes Service	62·4
Weight Tender Service	26·5
Water Litres	8,500
Coal Tonnes	4·0
Boiler length mm	6,150
Boiler tubes number	177
Boiler working pressure Bars	12
Cylinders	2
Cylinder Bore x stroke	430 x 560 mm
Cylinder valve control	Heusinger
Plough drive reduction gear 1:	1·77
Plough driveshaft diameter	220
Plough drive maximum rpm	250
Plough blades number	10
Plough blade length	1,105
Plough maximum rpm	140

An additional two unpowered snow plough units of similar design, Nos. 7-8, were delivered in 1893 to be followed in 1909 by a further two units Nos. 9-10. Only if the normal passive snowplough could not cope with the snowfall would the services of the Xrotd steam plough be called upon. When the time came to replace the steam-powered snowplough the SBB provided diesel-powered rotary snowploughs. The modern snowplough blades rotate - very much like a lawn mower - along the path of the plough, instead of rotating across the track as in the case of the rotary plough unit. This action breaks up the snow in front before throwing it to one side of the track. The diesel-powered ploughs are smaller and faster to get into operation and are located at strategic places along the route. Motive power where required is provided by electric- or diesel-powered shunting tractors.

ROTARY SNOW PLOUGH. Xrotd.

To ensure the Gotthard line remained open at all times during the winter, the GB placed an order for a steam driven rotary snowplough to be built. The manufacturer Henschel & Sohn of Kassel in Germany received the order and commenced erection of the unit under works number 2103, based on a design by the American railway engineer Leslie who had granted the company a builder's licence.

The power section consisted of a boiler and power transfer system driving a rotary snowplough, all mounted on an eight-wheel unpow-

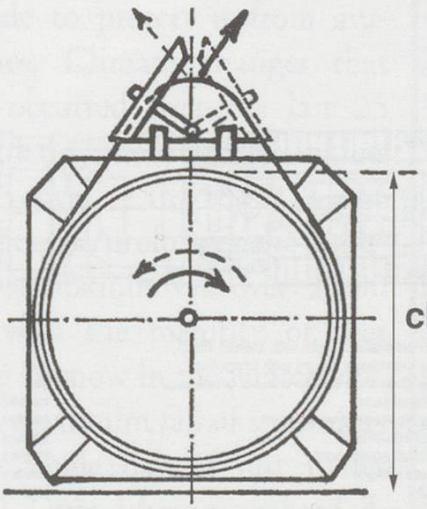


Hassell, Germany, 1896. The rotary snowplough type Xrotd waits outside the Henschel factory. Photo: MH-R collection

ered chassis. Motive power would be obtained from another source, which in the case of the GB was a locomotive of the class D4/4 or latterly when the SBB took over the line a C5/6. With the arrival of the electric locomotive this duty fell to either the Class Be4/6 or the Ce 6/8II.

On the rotary snowplough the 6·2-metre long boiler with its 177 x 50 mm tubes operated at 12 bars, having two Ramsbottom type safety valves for control. The firebox, with 9·8 m2 of heating area and the 93·6 m2 area of the fire tubes, provided a very respectable supply of wet steam for the plough. The output of steam from the steam dome, mounted just behind the chimney, fed two cylinders mounted inside the body and located above the frame. Each cylinder had a bore measuring 430 mm diameter and a stroke of 560 mm with valve control according to the Heusinger system. The front twin axle bogie was fitted with 850 mm diameter wheels and had a wheelbase of 1,370 mm. The wheelbase of the rear mounted bogie, also fitted with 850 mm diameter wheels, was 3,100 mm.

Steam powered Rotary Snowplough



When clearing snow the engine maintained a constant power output of 800 PS, although for a short period could achieve an output level of 1,300 PS. The firebox was mounted above the rear axle of the twin rearmost carrying wheels, and the cylinders above the front axle of the foremost carrying bogie. The cylinders powered a bevelled drive whose input shaft rotated at a maximum speed of 250 rpm. The drive system reduced the output drive shaft speed at a rate of 1:1·77. The output shaft was connected directly to the rotary snowplough blade system.

The plough mechanism consisted of ten paddle wheels each measuring 1·105 metres long mounted around the 220 mm diameter central shaft. Rotation speed had a maximum

level of 140 rpm, with the snow thrown clear of the track to either the left or right according to the setting of the rotation and the snow ejection guide located above the plough unit. Maximum clearance width of the snowplough measured 3·15 metres wide by 3·2 metres high. The clearance between the bottom of the plough unit and the top of the rails was 130 mm.

This engine was the first snow clearing unit to display a crest, which in this case was the Cantonal Crest of Uri mounted directly above the plough unit. The empty weight of the engine was 58,300 kg and the operating weight was 62,500 kg. Fuel supply for the engine was from a twin axle tender that had a water capacity of 8,500 litres and a coal capacity of 4·5 tonnes. The total tender service weight was 26,500 kg. A brake system, according to the Westinghouse principal, operated on the plough-carrying wheels, as well as via shoes on both the front and rear of each wheel of the tender. A manual backup in the form of a screw brake arrangement was provided.

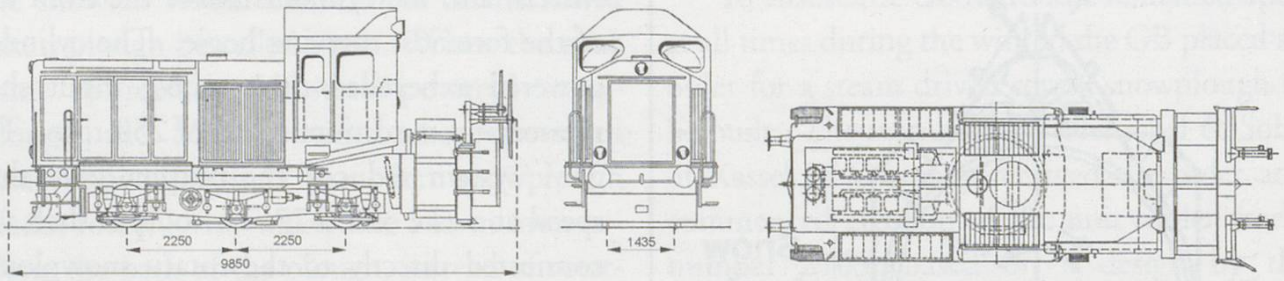
The handover of the rotary plough to the GB took place on the 17th January 1896. After preparation of the unit and trials, it went into service on the main line on the 8th March 1896 to tackle the effects of an avalanche. The unit did not have a running number until the SBB took over the GB when it received the number Xrotd No. 1, which changed - when the renumbering of the national railways took place in 1925 - to No. 100. The Erstfeld-based plough saw most of its service on the mountain sections of the line. Research did not reveal if it ever worked the Ceneri section of the Gotthard line. Considering the altitude and climate of that particular area it is unlikely. This plough remained the mainstay of the snow clearing fleet until 1982 when it retired into storage in the Erstfeld depot while awaiting space in the VHS museum in Luzern to become available. That space was found and the snowplough now forms part of the very impressive static display in the museum.

DIESEL POWERED SNOWPLOUGH. Xrotm.

The work of snow clearance after the retirement of the steam-driven plough has been handed over to two smaller but more efficient diesel-powered units. In these latest units the smaller snow-clearing blades rotate along the line of travel, whereas the steam powered blades of the Xrotd rotated across the track. The diesel units are also fitted with twin blades mounted in front of, and another two above the main clearing unit that chop up the snow drift and feed it onto the clearing blades which then throws the snow out from the track area.

The diesel ploughs were built by SLM in 1968, with a wheel formation of A-1-A, and sent

Diesel Powered Snowplough

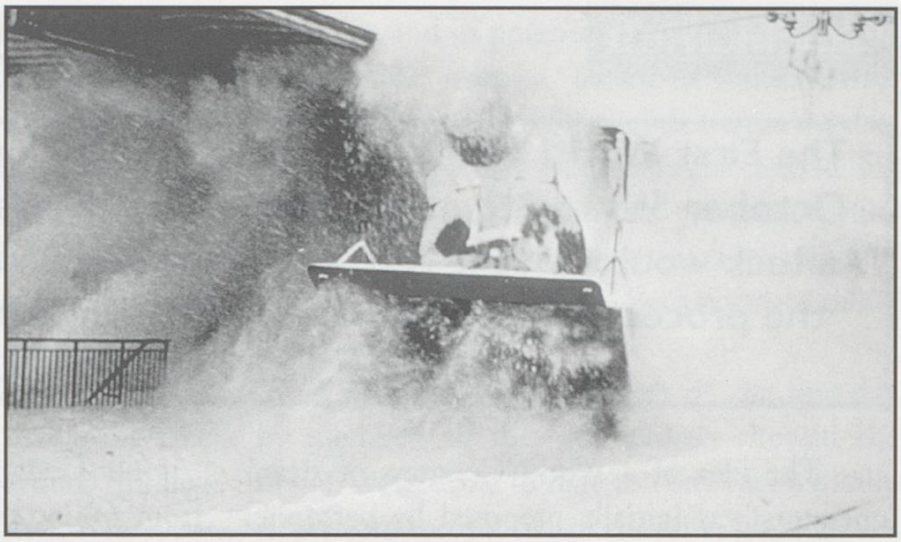


Driving wheel diameter	mm	850
Carrying wheel diameter	mm	700
Length overall	mm	9850
Total wheelbase	mm	4500
Rating continuous, Diesel motors.	HP	800
Rating 1 hour Diesel motors.	HP	900
Tractive effort.	kN	58.86
Maximum speed. Snow 0.5 metre depth, Weight 0.1kg/dm	km/h	18
Maximum transit speed	km/h	60
Normal snow clearance width.	Mm	3150

Maximum snow clearance width with blades fitted	mm	3500
Maximum snow clearance height with propellers	mm	3500
Maximum snow clearance height without propellers	mm	1500
Weight mechanical items	tonnes	22.8
Weight of snow clearaning equipment	tonnes	7.2
Weight of diesel equipment	tonnes	9.0
Weight of electrical equipment	tonnes	12
Maximum service weight	tonnes	54
Adhesion weight	tonnes	36

to SAAS/Beilhack for fitting out with diesel motor and control equipment. Delivery of No. 97 took place on the 7th November 1968 followed by No. 98 on the 20th November.

An 8 cylinder SLM 8YD 20 TrD diesel engine, rated at 800 HP constant output or 900 HP for one hour, powers two DC electrical generators to supply the two traction motors and all ancillary and control equipment. Traction motors are mounted above axles one and three, the central axle being unpowered. The ploughs are able to achieve a maximum transit speed of 60 km/h. When clearing snow with a depth of 0·5 metres with a density of 0·1 kg/dm3 this speed decreases to 18 km/h. The basic plough is able to clear snow up to a depth of 1·5 metres in height and up to 3·5 metres wide at a speed of 6 km/h. However, the plough can be fitted with two extra blades located above the main snow blades that increases the depth of snow capable of being cleared up to 3·5 metres.



Göschenen. Oops! The snow plough simultaneously clears the tracks and covers the platform. Photo: MH-R collection

The tasks for the modern units are not quite so onerous as those of the steam-powered unit, due to the fact that the modern main line is now covered in all the strategic places by galleries, or trees and barriers on the mountainside to protect it from avalanches. Climate changes that have occurred over the last 25 years have also resulted in less snow cover. In 1886 in the Göschenen/Airolo area the annual precipitation was over 2,000 mm with the majority of that falling as snow in the wintertime, and a maximum fall of snow during a single day of just under 1,000 mm being recorded. (Remember of course that 25 mm of rain is equal to approximately 250 mm of snow.) Today the amount of precipitation is slightly higher but the fall is now spread over the rest of the year in the form of rain which creates a different type of problem.

Now that SBB Historic is to take over all operational historic motive power and base them at Erstfeld, would it be too much to hope, boiler and frame condition permitting, that the Xrotd returns to its old haunts. Another post-dinner pipe dream!

Xrotd Steam Rotary snowplough.

Builder	Henschel & Sohn Cassel Germany		Date built1896
Length wheelbase 7,185	Length overall 17,172		
Brakes	Westinghouse, screw		
Weight, tonnes	Empty 58·3	Service 62·4	Tender 26·5
Water 8,500 litres	Coal 4,500 kgs		
Boiler length 6,150mm	Boiler tubes177		
Boiler working pressure	12 Bars		
Cylinders 2	Bore 430mm	Stroke 560mm	
Cylinder valve control	Heusinger		
Plough drive shaft dia. 220mm		Plough drive shaft input rpm 250	
Plough drive reduction 1:1·77		Plough drive shaft maximum rpm 140	
Plough blades length 1,105mm			
Plough blades number 10			
Maximum snow depth cleared 3,200mm		Maximum snow width cleared 3,150mm	

Xrotm Diesel Rotary snowplough

Built	SLM/SAAS/Beilhack		Date built1968
Drive wheel diameter 850mm			
Carrying wheel diameter 700mm			
Length	Overall 9,850mm		Wheelbase 4,500mm
Diesel power output, Continuous 800hp		Diesel output power, 1 HR 900hp	
Maximum snow clearing speed 20km/h			
Maximum transit speed 60 km/h			
Maximum snow depth cleared 3,500mm			
Maximum snow width cleared 3,150mm			
Maximum snow depth without 2nd blade set1,500			
Weight			
Mechanical equipment 22·8 tonnes		Snow plough equipment 7·2 tonnes	
Electrical equipment 12·0 tonnes		Adhesion 36·0 tonnes	Total 54·0 tonnes