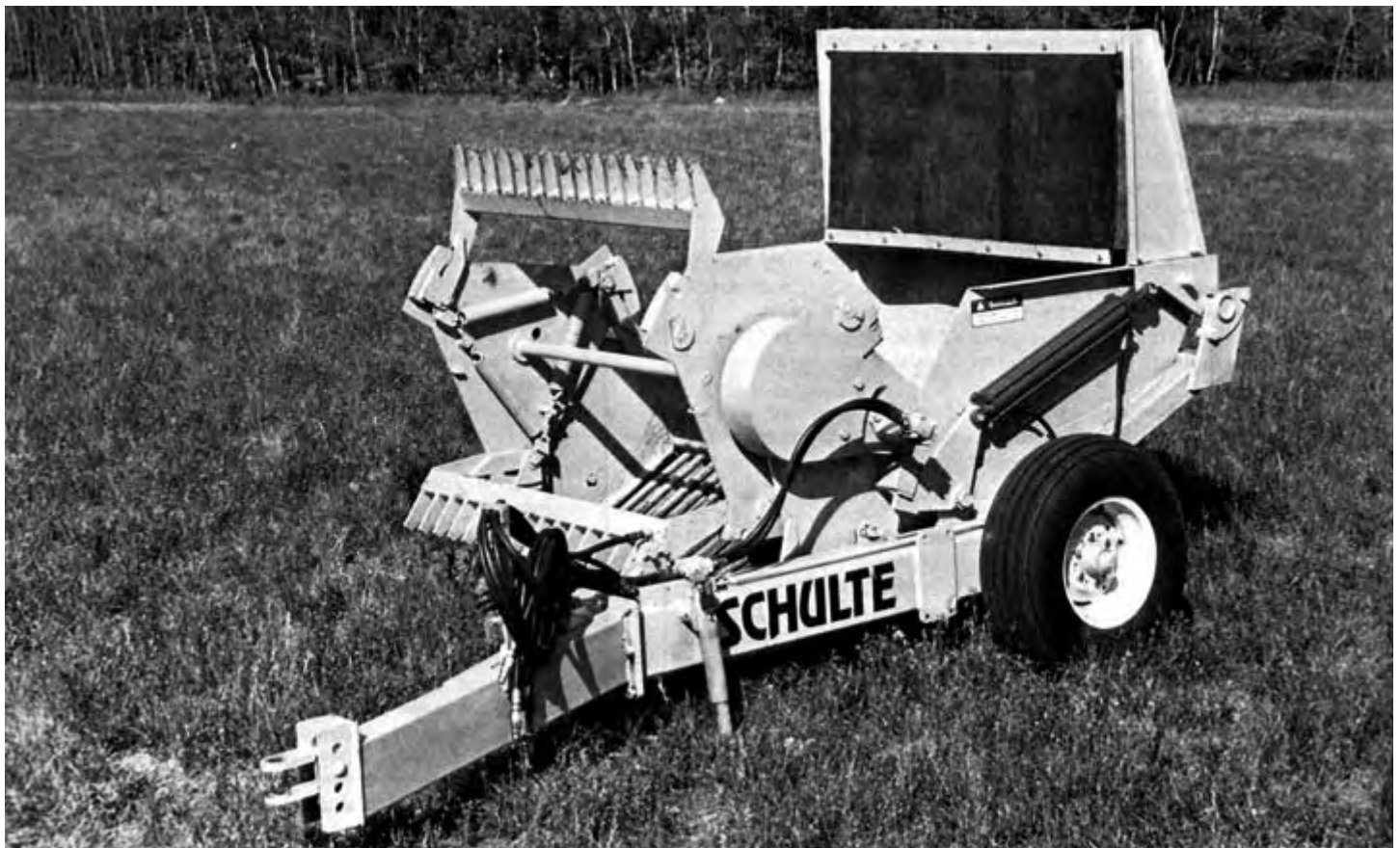


# Evaluation Report

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**Schulte RS 600 Rock Picker**

A Co-operative Program Between



# SCHULTE RS 600 ROCK PICKER

## MANUFACTURER AND DISTRIBUTOR:

Schulte Industries Ltd.  
 P.O. Box 70  
 Englefeld, Saskatchewan  
 S0K 1N0

## RETAIL PRICE:

\$6,210.00 (September, 1982, f.o.b. Humboldt, complete with optional hydraulic drive).



FIGURE 1. Schulte RS 600 Rock Picker.

## SUMMARY AND CONCLUSIONS

Overall functional performance of the Schulte RS 600 rock picker was good in both small and large rocks. Ease of operation and adjustment were good.

Typical field speeds were from 1 to 3 km/h (0.6 to 1.8 mph) in windrowed rocks and from 2 to 7.2 km/h (1.2 to 4.5 mph) in scattered rocks. Ground speed was usually limited by rock build-up on the grate. The Schulte RS 600 could pick rocks from 52 to 695 mm (2 to 27 in) in size. In rocks larger than 280 mm (11 in) the workrate was reduced by rocks occasionally jamming between the reel and the grate.

The amount of soil and trash delivered to the hopper depended on operating depth, reel speed and field conditions. In most conditions, soil retention was small.

Hopper capacity was about 1809 kg (3980 lb). The hopper dumping height of 1190 mm (47 in) was adequate for piling rocks.

A tractor with 45 kW (60 hp) maximum power take-off rating had sufficient power reserve to operate the Schulte RS 600 in most field conditions. The Schulte RS 600 transported well at speeds up to 40 km/h (25 mph).

The operator manual contained a parts list, assembly instructions, a list of safety precautions and information on adjustments and operating procedures.

The Schulte RS 600 was safe to operate as long as normal safety practices were observed. A serious safety hazard was encountered when removing rocks that had jammed between the reel bat and the grate. A slow moving vehicle sign was supplied.

## RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to prevent rocks from interfering with the grate lift.
2. Supplying an optional hydraulic valve kit for tractors that cannot divide the hydraulic flow to operate the grate lift and the reel at the same time.
3. Modifications to prevent rock and soil build-up at the rear of the grate.

4. Modifications to provide easier access to the grease fitting on the left reel bearing.
5. Improving the quality of the reel teeth welds.
6. Modifications to reduce damage to the rock guard when dumping the hopper.

Senior Engineer: G.E. Frehlich

Project Technologist: D.H. Kelly

## THE MANUFACTURER STATES THAT

With regard to recommendation numbers:

1. The bucket side plates will be modified to reduce the likelihood of rocks interfering with the grate lifting lugs.
2. An optional hydraulic kit for dividing the hydraulic flow will be made available, or the required components will be described to those encountering this problem.
3. The clearance between the bucket and the grate will be reduced and a cap will be placed on the frame cross member to prevent rocks and dirt from collecting on the frame.
4. The left reel bearing requires greasing only once in 50 hours of operation. At present, the bearing can be lubricated by removing the two bolts holding the drive shield. However, we will ensure that the bearing is positioned to permit access without removing the shield.
5. The quality of the reel teeth welds will be monitored more closely and our welding procedure will be reviewed.
6. We have not encountered any rock deflector problems other than those experienced by the Machinery Institute; however, we will monitor the situation. The operator's manual recommends that extra care be taken when dumping onto high rock piles.

**NOTE:** This report has been prepared using SI units of measurement. A conversion table is given in APPENDIX III.

## GENERAL DESCRIPTION

The Schulte RS 600 is a pull-type rock picker with a 1.5 m (58 in) wide grate. As standard equipment, it is supplied with a ground driven reel. The test machine was equipped with an optional hydraulic reel drive, powered by the tractor hydraulic system.

The Schulte RS 600 is designed for picking rocks from the soil surface. An inclined, adjustable finger grate, consisting of 15 steel bars spaced at 51 mm (2 in), operates just beneath the soil surface. Rocks are assisted onto the grate and conveyed along it, into a hopper, by a circular reel. The reel has three spring loaded bats, each with 16 teeth. Grate height and hopper dumping are hydraulically controlled.

Detailed specifications are given in APPENDIX I.

## SCOPE OF TEST

The Schulte RS 600 was operated in the conditions shown in TABLE 1 for 118 hours. The Schulte RS 600 was evaluated for rate of work, quality of work, ease of operation and adjustment, power requirements, safety and suitability of the operator manual.

TABLE 1. Operating Conditions

Rock Size	Hours
Less than 200 mm (8 in)	40
200 to 300 mm (8 to 12 in)	62
Greater than 300 mm (12 in)	16
Total	118
Rock Concentration	Hours
Light	15
Medium	95
Heavy	8
Total	118

## RATE OF WORK

Suitable field speeds ranged from 2 to 7.2 km/h (1.2 to 4.5 mph) in scattered rocks and from 1 to 3 km/h (0.6 to 1.8 mph) in windrowed rocks. Maximum speed was determined by operator skill, rock size, rock concentration, and field conditions. In heavy rock concentrations, rock build-up on the grate limited ground speed

to 3 km/h (2 mph). Ground speed was further reduced in rocks larger than 280 mm (11 in) since the reel occasionally jammed.

### QUALITY OF WORK

**Picking Characteristics:** The reel bat arms were spring loaded to allow the bats to retract up to 280 mm (11 in) to clear obstructions. The hydraulic reel drive was equipped with a pressure relief valve.

Reel aggressiveness was very good. However, if too many rocks were fed onto the grate, the reel bats would retract slightly and the hydraulic motor would stall, causing rock build-up on the grate. In heavy concentrations of small rocks (FIGURE 2), two passes were usually needed to remove most of the rocks.



A)



B)

FIGURE 2. Performance in Small Rocks: A) Before Picking, B) After Two Passes with Picker.

In large rocks (FIGURE 3), one pass was usually sufficient. Large rocks occasionally jammed between fully retracted reel bats and the grate, stopping the reel. Such rocks could usually be removed by reversing the reel.

The 1.5 m (58 in) grate was wide enough to accept most rock windrows. In non-windrowed areas of concentrated rock, a wider grate would be desirable.

**Reel Speed:** Proper reel speed was necessary to fully utilize hopper capacity and to obtain a maximum workrate. Rocks accumulated at the front of the hopper and reduced hopper capacity when the reel speed was too slow. If the reel speed was too fast, rocks were thrown over the back of the hopper. The rock guard reduced the number of rocks thrown over the hopper.

The operator manual recommended a reel speed of 30 to 40 rpm for most field conditions. A tractor capable of supplying a hydraulic flow of 36 L/m (8 gpm) was needed to run the reel at 37 rpm when using the hydraulic reel drive. This speed was adequate for most field conditions.

To effectively remove surface rocks and to minimize soil retention in the hopper, both the reel speed and the ground speed had to be selected to suit field conditions. In scattered rocks, best performance was achieved with a tooth index<sup>1</sup> of about 1.5 in fields with light rock concentrations, 2.3 in fields with medium rock concentrations and 5.4 in fields with heavy rock concentrations. In windrowed rocks, best performance was achieved with a tooth index of about 3.6 in fields with light rock concentrations, 5.4 in

<sup>1</sup>The tooth index is the ratio of the tangential tooth tip speed to the forward speed. A high tooth index gives aggressive picking action.

fields with medium rock concentrations and 10.8 in fields with heavy rock concentrations. Operating at the recommended reel speed of 37 rpm, corresponding ground speeds were about 7.2, 4.6 and 2 km/h (4.5, 2.8 and 1.2 mph) in scattered rocks for light, medium and heavy rock concentrations, respectively. In windrowed rocks, ground speeds were about 3, 2 and 1 km/h (1.8, 1.2 and 0.6 mph) for light, medium and heavy rock concentrations, respectively.



A)



B)

FIGURE 3. Performance in Large Rocks: A) Before Picking, B) After One Pass with Picker.

**Operating Depth:** Operating with the grate just touching the soil surface was adequate for removing rocks lying on the surface, but partially buried rocks were pushed into the soil by the grate. Operating the grate 25 mm (1 in) below the surface aided in removal of small embedded rocks, providing the field was not too firm. Caution was needed to prevent damage to the grate and frame when working in fields containing large embedded rocks.

Occasionally rocks falling from the hopper landed on the frame and prevented the grate from being lowered. Modifications to prevent rocks from interfering with the grate lift are recommended.

**Trash and Soil Retention:** The amount of soil and trash placed in the hopper depended on machine operation and field preparation. The amount of soil retained was small in most field conditions. Operating with the grate set too low, the reel speed too fast or in fields containing dirt lumps or trash, increased the amount of soil and trash retained. Properly formed, clean windrows were necessary to minimize soil retention when picking fields windrowed with a rock rake.

**Field Preparation:** Best performance was in fields with a firm base and a minimum amount of trash or dirt lumps. It is often desirable to use a rod weeder before picking, to place rocks on the surface, and to firm the soil.

The use of a rock rake is recommended when working in fields with an abundance of rocks smaller than 300 mm (12 in). The rock rake brings most rocks to the surface and reduces picking time.

**Stability:** The Schulte RS 600 was very stable. Skewing occurred only when the grate hooked large subsurface rocks. When this occurred, the grate either jumped over the rock or the picker skewed to the left until the grate cleared the rock.

**Rock Size:** The Schulte RS 600 could effectively remove rocks ranging in size from 50 mm (2 in) to 695 mm (27 in). Rocks smaller than 50 mm (2 in) fell through the grate and remained in the field. Rocks larger than 695 mm (27 in) would not pass between the reel centre shaft and the grate.

**EASE OF OPERATION AND ADJUSTMENT**

**Reel Drive:** The test machine was equipped with the optional hydraulic reel drive, powered by the tractor remote hydraulics. Reel speed could be varied by adjusting a flow control valve on the rock picker. The operator manual recommended that a tractor with a hydraulic system capable of 10,300 kPa (1500 psi) at 54 L/m (12 gpm) be used. The test machine was operated with a tractor capable of 15,500 kPa (2250 psi) at 68 L/m (15 gpm). This was adequate for most field conditions. The hydraulic pressure relief valve effectively prevented damage to the reel and grate during the test.

On some tractors, the grate lift response was very slow when the reel was operating, even though the tractor hydraulic flow was sufficient to operate the reel and grate lift at the same time. Although the tractor flow was adequate it could not be properly divided between the two functions. It is recommended that the manufacturer supply an optional valve kit to allow the rock picker to be used on these tractors.

Bat force was adjusted by changing the tension of the reel springs. Clearance between the bat teeth and the grate was not adjustable.

The reel could be easily reversed from the tractor to clear rock blockages or build-up on the grate.

**Hopper Dumping:** The hopper held about 1809 kg (3980 lb) of large or small rocks when completely filled (FIGURE 4). One pair of tractor remote hydraulic outlets raised the hopper for dumping and controlled the grate height. To dump the hopper, the hydraulics were activated to lower the grate. With the grate fully lowered the hopper began to rise. The hopper emptied completely and could pile rocks 1190 mm (47 in) high.



FIGURE 4. Typical Hopper Load.

Rocks and soil collected on the cross member at the rear of the grate and prevented the hopper from being completely lowered after dumping (FIGURE 5). Modifications to prevent rock and soil build-up at the rear of the grate are recommended.



FIGURE 5. Rock and Soil Build-up at the Rear of the Grate.

**Maneuverability:** The Schulte RS 600 was quite maneuverable. Its turning radius was short enough for easy operation, however, normal care had to be taken to prevent interference between the tractor tire and the picker frame when making right turns.

Since it is desirable to feed rocks into the rock picker without driving over them, the distance between the hitch and the outside of the right tractor tire should not exceed 900 mm (35 in).

**Transporting:** The Schulte RS 600 was easily transported. It towed well at speeds up to 40 km/h (25 mph). The 140 mm (6 in) transport clearance was adequate. The transport locks were easy to install and a storage location was provided when they were not in use.

**Hitching:** The Schulte RS 600 was easily hitched to a tractor. A hitch jack was provided and the hitch clevis was fixed allowing one-man hook-up. The hitch clevis was adjustable vertically to permit frame levelling.

**Ease of Servicing:** Servicing was easy. Most grease fittings and chains required lubrication daily. Lubrication points were accessible except for the grease fitting on the left reel bearing which was located behind the drive chain shield. Modifications to provide easier access to the grease fitting on the left reel bearing are recommended.

**POWER REQUIREMENTS**

A tractor with 45 kW (60 hp) maximum power take-off rating had sufficient power reserve to operate the Schulte RS 600 in most conditions. Average power requirements varied widely, depending on field conditions. High draft forces occurred when the grate hooked partially buried rocks.

**OPERATOR MANUAL**

The operator manual contained a parts list, assembly instructions, a list of safety precautions and information on adjustments and operating procedures.

**OPERATOR SAFETY**

The Schulte RS 600 was safe to operate and service as long as common sense was used in following good safety procedures.

Rocks that jammed between the reel bat and the grate during the tests were removed by reversing the reel. However, extreme caution is recommended if a rock has to be removed by hand. Serious bodily harm could result if a retracted reel bat suddenly released when the operator was removing the rock.

**DURABILITY RESULTS**

TABLE 2 outlines the mechanical history of the Schulte RS 600 during 118 hours of field operation. The intent of the test was functional evaluation. The following mechanical problems are those, which occurred during the functional testing. An extended durability test was not conducted.

TABLE 2. Mechanical History

Item	Hours
Reel:	
-Several reel teeth welds cracked and were re-welded at	21, end of test
Hopper:	
-The rock guard frame bent and was repaired at	14
Tires:	
-The right rock picker tire was punctured by a rock and was replaced at	44
Frame:	
-The left side of the main rock picker frame failed and was repaired at	end of test

**DISCUSSION OF MECHANICAL PROBLEMS**

**Reel:** Several reel teeth welds cracked throughout the test. Modifications to improve the quality of the reel teeth welds are recommended.

**Hopper:** The rock guard frame bent while dumping rocks onto a rock pile. The rock guard frame is lower than the rear hopper edge when the hopper is fully raised to dump (FIGURE 6). It is recommended that the manufacturer consider modifications to reduce damage to the rock guard when dumping onto rock piles.

**Frame:** The left frame cracked where it joins the frame crossing to the right side. The failure occurred because the gusset joining the two frames had been tacked in place but not properly welded during production.



FIGURE 6. Rock Guard Frame Hitting a Rock Pile While Dumping.

**APPENDIX I  
SPECIFICATIONS**

<b>MAKE:</b>	Schulte Rock Picker
<b>MODEL:</b>	RS 600
<b>SERIAL NUMBER:</b>	N/A
<b>WEIGHT:</b> (hopper empty)	
-- left wheel	640 kg
-- right wheel	725 kg
-- hitch	255 kg
TOTAL	1620 kg
<b>TIRES:</b>	2, 11L x 15SL, 6-ply
<b>OVERALL DIMENSIONS:</b>	
-- width	2900 mm
-- height	2000 mm
-- length	4280 mm
-- ground clearance	140 mm
<b>GRATE:</b>	
-- width	1460 mm
-- number of grate bars	15
-- space between grate bars	52 mm
-- length of grate bars	790 mm
-- grate angle while operating	45 degrees
<b>REEL:</b>	
-- diameter	1550 mm
-- number of bat arms	3
-- number of teeth per bat	16
-- spacing between teeth	72 mm
-- tooth length	140 mm
-- reel speed	0 to 54 rpm at 55 L/m
<b>HOPPER:</b>	
-- hopper dumping height	1190 mm
-- hopper capacity	1809 kg
<b>HYDRAULIC MOTOR:</b>	1, Char-Lynn No. 104 1027 005
<b>NUMBER OF HYDRAULIC CYLINDERS:</b>	2
<b>NUMBER OF CHAIN DRIVES:</b>	1
<b>NUMBER OF LUBRICATION POINTS:</b>	9
<b>OPTIONAL EQUIPMENT:</b>	hydraulic drive

**APPENDIX II  
MACHINE RATINGS**

The following rating scale is used in Machinery Institute Evaluation Reports:

a) excellent	d) fair
b) very good	e) poor
c) good	f) unsatisfactory

**APPENDIX III  
CONVERSION TABLE**

1 hectare (ha)	= 2.5 acres (ac)
1 kilometer/hour (km/h)	= 0.6 miles/hour (mph)
1 metre (m)	= 3.3 feet (ft)
1 millimeter (mm)	= 0.04 inches (in)
1 kilowatt (kW)	= 1.3 horsepower (hp)
1 kilogram (kg)	= 2.2 pounds mass (lb)



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