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Evaluation Report 282

Kongskilde Model SUCB 500 Suction Blower (Power Take-off Drive)

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

KONGSKILDE MODEL SUCB 500 SUCTION BLOWER

MANUFACTURER:

Kongskilde Limited
P.O. Box 880
Thames Road East
Exeter, Ontario
N0M 1S0

DISTRIBUTOR:

Alteen Distributors Limited
P.O. Box 6450
Wetaskiwin, Alberta
T9A 2G2

RETAIL PRICE:

$11,681.00 (July 1, 1982 f.o.b. Wetaskiwin, Alberta) complete with standard package which includes intake nozzle and truck loading kit with discharge cyclone).

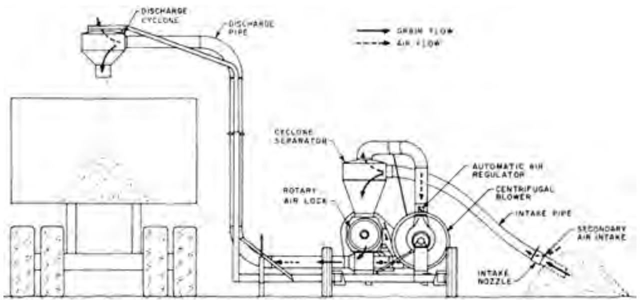


FIGURE 1. Schematic View Showing Air and Grain Flow.

SUMMARY AND CONCLUSIONS

The functional performance of the Kongskilde Model SUCB 500 suction blower was good for conveying wheat, barley, oats and canola. Functional performance was lowered by high power consumption.

The maximum conveying rates obtained were 32.0 t/h (1180 bu/h) for wheat, 29.9 t/h (1370 bu/h) for barley, 36.9 t/h (2390 bu/h) for oats and 37.3 t/h (1640 bu/h) for canola. Conveying rates were reduced when intake or discharge pipe lengths were increased. Conveying rates could be increased by using rigid rather than flexible intake pipe and using better seals for joining lengths of intake pipe.

Power requirements while conveying grain varied from 32 to 42 kW (43 to 56 hp). A tractor with maximum power take-off output of at least 50 kW (67 hp) was required due to high starting torques.

The specific capacity of an average 178 mm (7 in) diameter grain auger was four times greater than that of the Kongskilde SUCB 500 in wheat, and oats and three times greater in canola. This indicates that pneumatic conveying of grain is inefficient in terms of power required for the amount of grain moved when compared to a grain auger. However, pneumatic conveyors have advantages a grain auger doesn't have. For example, they are capable of conveying grain over longer distances, both vertically and horizontally, than is possible with a grain auger.

Crackage in dry wheat was less than 0.4% for each pass through the Kongskilde SUCB 500. This is similar to damage caused by grain augers.

The two types of intake nozzles were fairly easy to maneuver during bin clean-out when using the flexible vinyl clean-out hose and complete clean-out could be accomplished using the flat nozzle. Mounting the discharge cyclone for field position was inconvenient.

The Kongskilde SUCB 500 was much safer to use than a grain auger, especially for cleaning grain bins. Working near the inlet nozzle was clean, as most dust was conveyed into the inlet. It was also safer than an auger since the operator was exposed to fewer moving parts. Noise levels adjacent to the conveyor varied from 93 to 98 dBA when operating in open areas. When operating close to metal bins the noise level was loud and irritating. It is recommended that an operator wear suitable ear protection when working near the Kongskilde SUCB 500.

Several mechanical failures occurred during the test. There were several air leaks in the piping and the flexible vinyl cleanout hose collapsed.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Supplying flexible intake and clean-out hoses that do not conduct static electricity.
2. Modifying the hitch jack and its location to improve accessibility, stability and lifting height, as well as eliminating interference.
3. Improving the seals used in the pipe quick couplers to prevent leakage of air at the joints.
4. Supplying a slow moving vehicle sign as standard equipment.
5. Supply a more complete operator's manual containing information on safety, operation, servicing, and adjustments.
6. Supplying a more durable flexible clean-out hose.

Senior Engineer: E. H. Wiens
Project Engineer: R.P. Atkins
Project Technologist: G.A. Magyar

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. The hoses are now supplied with the inner steel wire connected to the pipe stub in the ends. This eliminates electricity problems, except when sucking from a synthetic hopper.
2. This recommended change was made in 1981 and the blower is now delivered with a Canadian made crown jack.
3. New improved quick release clamps with a locking device were introduced early 1982.
4. This recommendation is well taken and will be followed.
5. A new operator's manual describing fields of application, the nature of pneumatic conveying, piping instructions, maintenance and a detailed list of technical data was produced early in 1982.
6. The flexible clean-up hose is under continuous development to come up with a light weight, flexible, easy-to-handle hose.

MANUFACTURER'S ADDITIONAL COMMENTS

A new unit, the SUC TRII, has been developed which eliminates the weaknesses of the SUCB 500. It features a truck loading kit, which can be moved up and down via telescopic movement. Also, the discharge cyclone can be moved six feet horizontally during loading. This unit will be available in Canada and the USA in December 1982.

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

GENERAL DESCRIPTION

The Kongskilde SUCB 500 is a 540 rpm, power take-off driven pneumatic grain conveyor, mounted on a two wheel trailer. The three stage centrifugal blower (FIGURE 1) provides both suction and discharge air to convey grain without passing it through the blower. Grain is conveyed by the intake airstream through the intake nozzle, through the cyclone separator and into the rotary air lock. It then passes through the air lock into the discharge airstream, which delivers it to the discharge cyclone.

The blower is driven from the power take-off shaft by a multi V-belt pulley arrangement. The rotary air lock is driven from the power take-off by two V-belts.

Intake and discharge locations can be varied by adding elbows and sections of 160 mm (6.3 in) diameter rigid pipe and 150 mm (5.9 in) or 160 mm (6.3 in) diameter flexible pipe. The rigid pipe is galvanized metal tubing while the flexible pipe is wire reinforced vinyl or rubber hose.

FIGURE 1 shows the location of major components while detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Kongskilde SUCB 500 was used for 21 hours to convey the various grains and fertilizers shown in TABLE 1. It was evaluated for ease of operation and adjustment, rate of work, power requirements, quality of work, operator safety and suitability of the operator's manual.

TABLE 1. Operating Conditions

Material	Quantity Conveyed (t)	Hours
Spring Wheat	60.0	6.5
Winter Wheat	11.0	1.0
Durum	46.0	3.5
Canola	7.5	1.0
Oats	6.0	1.0
Barley	91.0	7.5
Granular Fertilizer	5.4	1.5
TOTAL	226.9	21.0

RESULTS AND DISCUSSION

EASE OF OPERATION AND ADJUSTMENT

Standard Discharge: The standard discharge assembly (FIGURE 2) consisted of two 90° elbows and three lengths of galvanized pipe. This assembly was designed for conveying grain from a bin to a truck. The 3.9 m (12.8 ft) discharge height and 1.7 m (5.7 ft) reach were insufficient for filling grain bins but easily accommodated all common truck box heights.

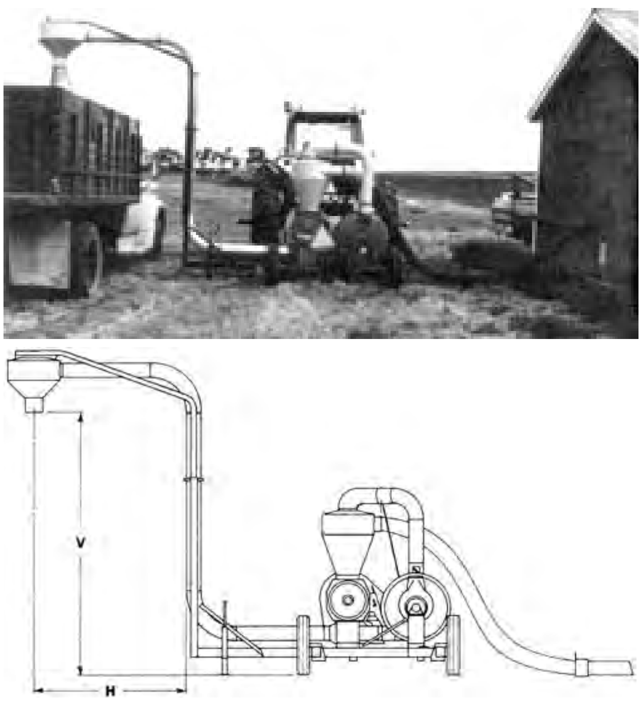


FIGURE 2. Standard Discharge Assembly (V = 3.9 m, H = 1.7 m).

The discharge cyclone should be removed when transporting long distances or over rough ground. The discharge cyclone weighed 20 kg (44 lb) and was difficult for one man to attach or remove since no provision was made for lowering the discharge boom.

Conveying Pipes: Rigid pipe sections were available in 0.3, 0.6, 1.0 and 2.0 m (1, 2, 3.3 and 6.6 ft) lengths. The standard intake was a 2.8 m (9.8 ft) length of 160 mm (6.3 in) diameter rubber, wire reinforced flexible hose. An optional 4.6 m (15 ft) length of 150 mm (5.9 in) diameter vinyl, wire reinforced flexible hose was also supplied for use in bin clean-out. Adjacent pipes and elbows were easily joined with quick couplers. Flow directions could be easily changed by using 90°, 45°, 30° and 15° elbows.

Intake Nozzles: Two types of intake nozzles were available. The round intake nozzle (FIGURE 3) was used for normal grain conveying, while the flat intake nozzle was used for bin cleanout. Both nozzles could be used to clean out bins but maneuverability was difficult in square bins with tie rods. During clean-out, the operator was periodically subjected to static electricity shocks from the flexible vinyl hose. Static electricity shocks were also received from the standard flexible rubber intake hose. This became very annoying to the operator and also presented a safety hazard. It is recommended that the manufacturer use non-static electricity producing flexible intake and clean-out hoses.

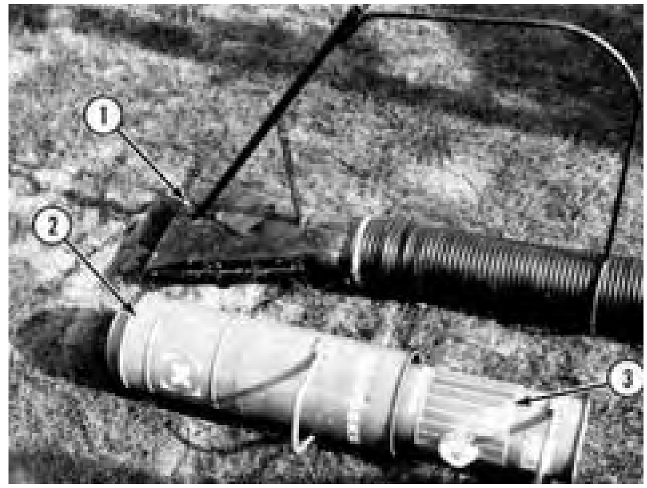


FIGURE 3. Intake Nozzles: (1) Flat Nozzle, (2) Round Nozzle, (3) Adjustable Sleeve.

Transporting: The Kongskilde could be placed in transport position by uncoupling at the rotary air lock and swinging the discharge assembly to be positioned over the trailer hitch. The Kongskilde was quite unstable in this position and could be moved only short distances at slow speeds. When towing with tractors equipped with cabs, clearance between the discharge cyclone and tractor cab was small (FIGURE 4) and interference could occur. For high speed transporting over long distances, the discharge cyclone had to be removed (FIGURE 5). This took two people with tools and a front end loader at least 15 minutes. No provision was made on the machine for carrying the discharge cyclone, intake hose and intake nozzle in this transport mode. With the discharge cyclone removed, the Kongskilde SUCB 500 could be safely towed at speeds up to 60 km/h (38 mph).

FIGURE 4. Limited Clearance in Transport Position between Discharge Cyclone and Tractor Cab.

Hitching: The Kongskilde was easily hitched to tractors with a 540 rpm power take-off. The hitch jack was somewhat inaccessible in transport position (FIGURE 6) and difficult to operate. The screw jack did not operate smoothly and would not raise the hitch high enough for most tractors. The Kongskilde, when stationary and supported by the jack in transport position, was unstable and could tip over in the wind (FIGURE 7). The jack, in field position, was used as a stabilizer for the discharge assembly. In this position, interference occurred between the jack handle and discharge cyclone support brace (FIGURE 8). It is recommended that the manufacturer modify the jack and its location to improve accessibility, stability and lifting height, as well as eliminating interference.

FIGURE 5. Transport Position with Discharge Cyclone Removed.

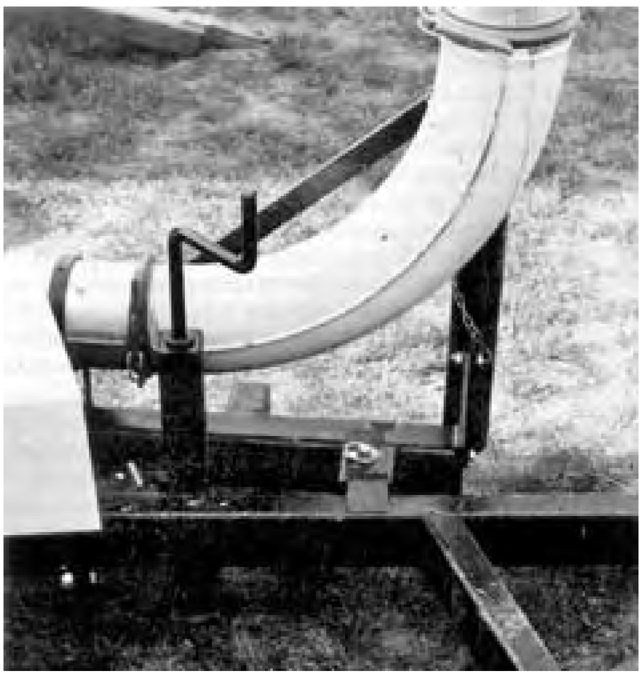


FIGURE 6. Hitch Jack Inaccessibility in Transport Position.

Adjustments: All belts could be easily tightened and all pulleys easily aligned with the available adjusting rods. No special tools were required.

Secondary air flow into the intake nozzle could be easily varied with the adjustable sleeve provided (FIGURE 3). The sleeve was easily rotated to increase the secondary air opening. The size of opening was conveniently indicated for easy reference by a scale from 0 to 10 on the intake nozzle.

Servicing: The Kongskilde SUCB 500 had 5 grease fittings on the power take-off shaft and 2 seals on the air lock that had to be oiled. The Kongskilde could be serviced in less than 10 minutes. Recommended servicing frequency of the air lock seals indicated they should be oiled prior to the off season to prevent rusting onto the housing. Due to condensation occurring at these points and to prevent seizing of the air lock, more frequent and regular servicing is recommended.

RATE OF WORK

Maximum Conveying Rates: Conveying rates for the Kongskilde SUCB 500 depended on the type of grain being conveyed, the secondary air slide setting on the intake nozzle and the length of intake and discharge pipe. The conveying rate was very dependent upon maintaining a steady flow rate. Highest conveying rates were obtained with the intake nozzle completely submerged in grain, using the shortest possible length of intake and discharge pipe (FIGURE 3). As shown in TABLE 2 the maximum conveying rates were 32.0 t/h (1180 bu/h) in wheat, 36.9 t/h (2390 bu/h) in oats, 37.3 t/h(1640 bu/h) in canola and 29.9 t/h (1370 bu/h) in barley. The wide range of conveying rates in TABLE 2 indicates the difficulty adjusting the intake nozzle air opening to obtain maximum conveying rates.

FIGURE 7. Unstable Transport Position.

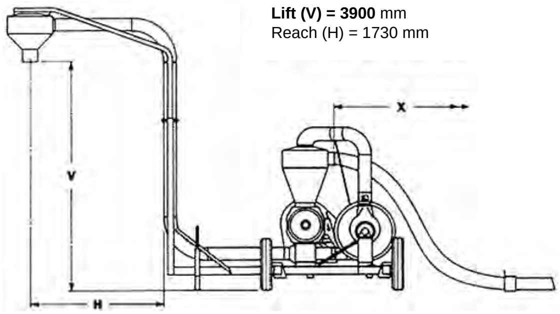
FIGURE 8. Interference between Jack Handle and Discharge Cyclone Support Bracket.

Secondary Air Setting: The amount of secondary air introduced at the intake nozzle was important in obtaining maximum conveying rates. Too little secondary air caused the conveyor to surge. Too much secondary air resulted in inefficient conveying due to reduced suction at the intake. The secondary air setting depended on the density of the material being conveyed and length of conveying pipe. For example, FIGURE 9 indicates the effect of secondary air setting on conveying rate in canola, using the standard intake and discharge assembly. The optimum scale setting was 1.75, which resulted in a conveying rate of 36.0 t/h (1590 bu/h). Maximum conveying rates obtained at optimum secondary air settings coincided closely with maximum conveying rates indicated by the automatic air regulator. Therefore, the operator could adjust the secondary air setting by using the indicator on the automatic air regulator.

TABLE 2. Conveying Rates at 540 rpm Power Take-Off Speed.

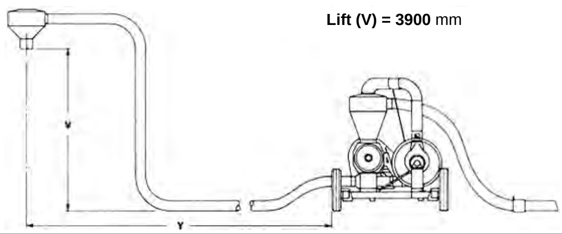
With Standard Discharge Assembly (FIGURE 2) and Various Intake Pipe Lengths (FIGURE 10).

Lift (V) = 3900 mm
Reach (H) = 1730 mm



One Length of Flexible Intake Pipe and Various Discharge Pipe Lengths (FIGURE 11.)

Lift (V) = 3900 mm



	Intake Pipe Length (X)			Discharge Pipe Length (Y)	
Grain	**3.0 m**	**15.2 m**	**30.5 m**	**15.2 m**	**30.5 m**
Wheat	28.4 to 32.0 t/h	18.2 to 19.2 t/h	13.6 to 14.7 t/h	19.3 to 21.6 t/h	17.1 to 20.0t/h
Barley	26.0 to 29.9 t/h		12.0 to 16.4 t/h		17.2 to 21.8 t/h
Oats	27.8 to 36.9 t/h		14.5 to 16.0 t/h		20.9 to 24.2 t/h
Canola	32.0 to 37.3 t/h		13.8 to 15.8 t/h		19.3 to 22.9 t/h

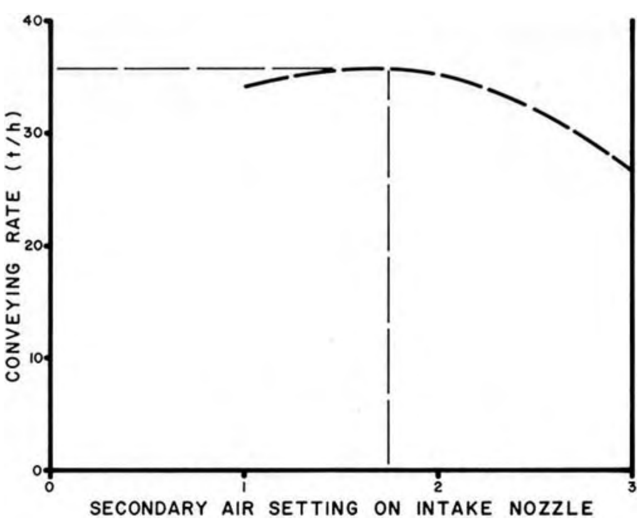


FIGURE 9. Conveying Rates in Canola for Various Secondary Air Settings.

Effect of Pipe Length: Conveying rates decreased with increased intake pipe length. For example, increasing the intake length from 3.0 to 30.5 m (9.8 to 100 ft) (FIGURE 10) reduced the maximum conveying rate from 32.0 to 14.7 t/h (1180 to 540 bu/h) in wheat, from 36.9 to 16.0 t/h (2390 to 1040 bu/h) in oats, from 37.3 to 15.8 t/h (1640 to 700 bu/h) in canola and from 29.9 to 16.4t/h (1370 to 753 bu/h) in barley.

Increasing the discharge pipe length also reduced the conveying rate. The standard discharge assembly had a reach of 1.7 m (5.6 ft). Increasing the discharge pipe length to 30.5 m (100 ft) (FIGURE 11) reduced the conveying rate from 32.0 to 20.0 t/h (1180 to 735 bu/h) in wheat, from 37.3 to 22.9 t/h (1640 to 1010 bu/h) in canola, from 29.9 to 21.8 t/h (1370 to 1000 bu/h) in barley and from 36.9 to 24.2 t/h (2390 to 1570 bu/h) in oats.

FIGURE 10. Increased Intake Pipe Length.

FIGURE 11. Increased Discharge Pipe Length.

Effect of Pipe Type: Conveying rates were greater when using rigid pipe and elbows (FIGURE 12) instead of the standard flexible inlet pipe (FIGURE 2). The maximum conveying rate in wheat increased from 32.0 to 43.5 t/h (1180 to 1600 bu/h) (FIGURE 13) when using the rigid pipe assembly. Flexible hose with better conveying properties would increase capacity significantly.

FIGURE 12. Rigid Intake Pipe Assembly.

Effect of Pipe Couplers: During field testing it was noticed that the quick pipe couplers supplied were not air tight. Rubber inner tube seals were installed over each joint (FIGURE 14) and the quick clamp placed over the seal. When conveying through 30.5 m (100 ft) of intake pipe, the conveying rate increased from 14.7 to 17.9 t/h (540 to 660 bu/h) in wheat when using air tight pipe joints. Air tight joints on the discharge line did not significantly increase the conveying rate. It is recommended that the manufacturer improve the seals used in the pipe couplers to prevent air leakage at the joints.

Comparison to a Grain Auger: TABLE 3 compares the performance of the Kongskilde SUCB 500 to that of an average 178 mm (7 in) diameter, 12.5 m (41 ft) long grain auger at 30° inclination, with a lift of 6.4 m (21 ft). Data for the Kongskilde SUCB

500 was obtained with the standard discharge and 2.8 m (9.3 ft) of standard flexible intake hose. The maximum conveying rate for the Kongskilde SUCB 500 was 22% less than the grain auger in spring wheat, 30% more than the grain auger in oats and 5% less than the grain auger in canola.

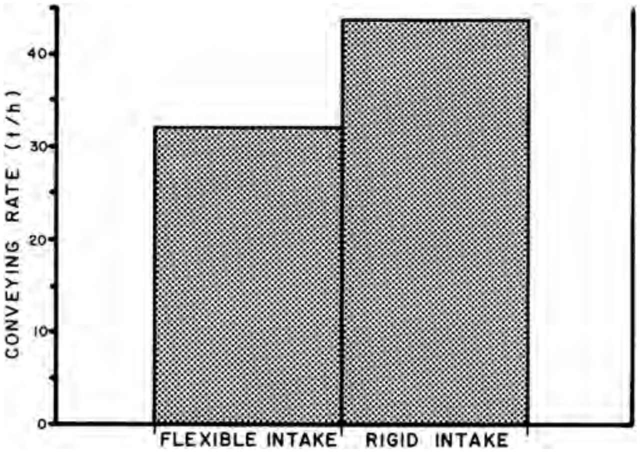


FIGURE 13. Effect of Pipe Type on Conveying Rates in Wheat.

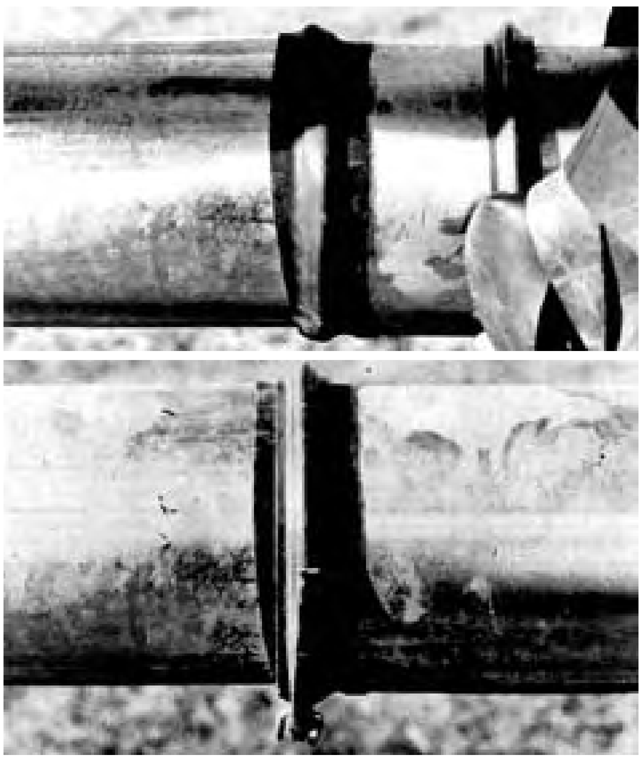


FIGURE 14. Pipe Connection (Upper: Rubber Seals over Joint, Lower: Clamp Placed over Rubber Seal.)

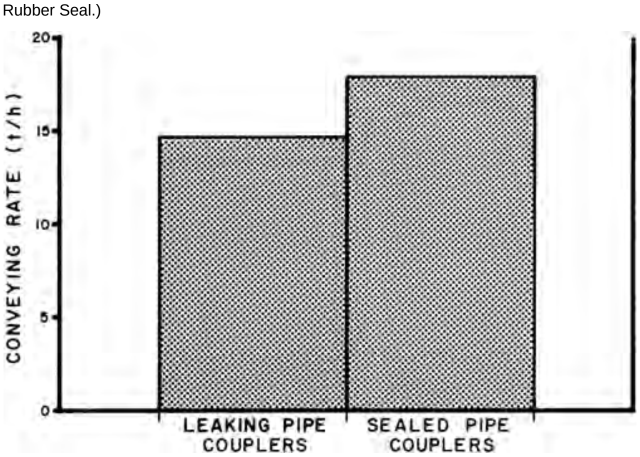


FIGURE 15. Effect of Air Tight Pipe Couplers in Wheat.

TABLE 3. Comparison of the Kongskilde SUCB 500 to an Average 178 mm Diameter Grain Auger.[1]

Grain Type	Maximum Conveying Rates (t/h)		Specific Capacities/Meter Vertical Lift (tkWh)	
	Kongskilde	Grain Auger*	Kongskilde	Grain Auger*
Wheat	32.0	41.0	0.32	1.25
Oats	36.9	28.2	0.39	1.53
Canola	37.3	39.4	0.39	1.03

Specific capacity can be used to compare the conveying efficiency of the two methods of grain handling. A high specific capacity indicates efficient energy use while a low specific capacity indicates inefficient conveying. The specific capacity per metre of vertical lift for the grain auger was about four times greater than that of the Kongskilde SUCB 500 in wheat and oats, and about three times greater in canola. This indicates that pneumatic conveying is inefficient as compared to a grain auger. However, pneumatic conveyors have advantages that grain augers do not have. They are capable of conveying grain over longer distances, both vertically and horizontally, than is possible with a grain auger. Pneumatic conveyors are also safer to operate than grain augers.

POWER REQUIREMENTS

FIGURE 16 shows that the maximum power take-off input was 42.2 kW (57 hp) when the Kongskilde SUCB 500 was running empty and conveying only air. As grain was conveyed, less air was pumped, reducing the power requirement. Power input during grain conveying depended upon the amount of air allowed to enter the conveyor as controlled by the secondary air intake and leaks in the suction line. At maximum conveying rates average power requirements were 38.5, 34.6, 33.1 and 32.5 kW (51.6, 46.4, 44.4 and 43.5 hp) in barley, wheat, canola and oats, respectively.

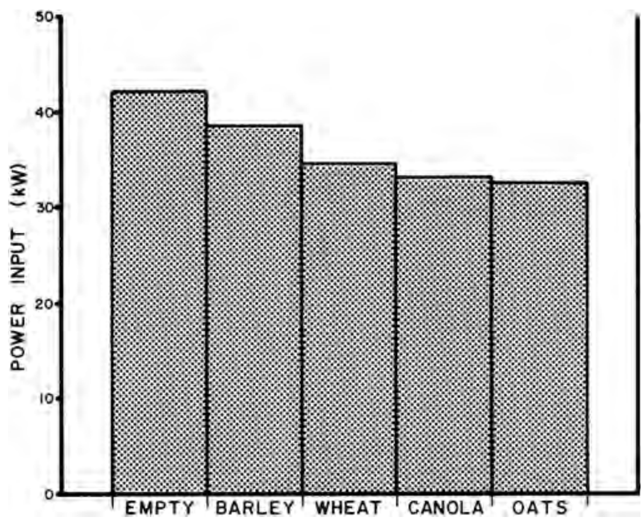


FIGURE 16. Power Requirements at Maximum Conveying Rates.

Start-up torques for the Kongskilde SUCB 500 were very high. Engaging the power take-off slowly at the lowest possible idle speed reduced initial power requirements. Because of high starting torques and peak requirements during plugging, a minimum tractor size of 50 kW (67 hp) is recommended.

QUALITY OF WORK

Grain Damage: FIGURE 17 shows the increase in grain crackage each time a sample of dry wheat (11.3% moisture content) was conveyed. In these tests the Kongskilde SUCB 500 was equipped with the standard discharge assembly (FIGURE 2) and 4.6 m (15 ft) of flexible intake hose. The wheat initially contained 3.2% cracks. Each pass through the Kongskilde SUCB 500 caused an average 0.4% increase in crackage. This indicates that if the number of passes is kept to a minimum, grain damage should not be a problem. Test results from grain augers in dry wheat have shown that each pass through an auger causes less than 0.2% crackage.

[1] *Grain auger data represents average data results from Machinery Institute test report reports 89, 90 and 92.*

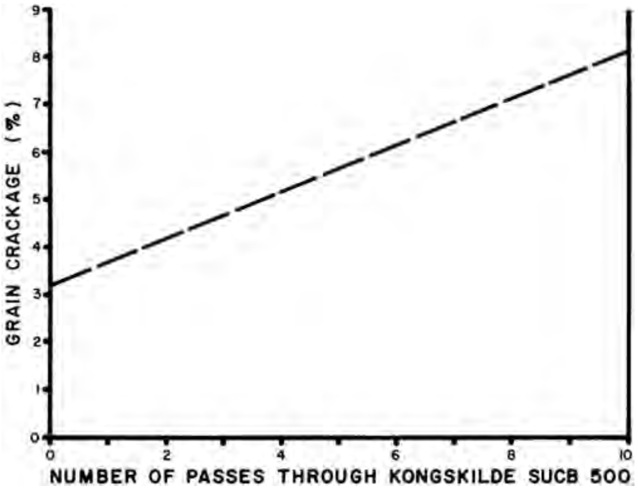


FIGURE 17. Grain Crackage in Dry Wheat.

Plugging: Plugging occurred when insufficient air entered the inlet to carry the material being conveyed. Proper adjustment of the secondary air inlet was essential to prevent plugging. Plugging could also occur if too much material was introduced during bin clean-out. The Kongskilde SUCB 500 could be unplugged by discontinuing grain intake and allowing air to clear the blockage.

The screen in the cyclone partially plugged when handling granular fertilizer. Thorough screen cleaning was needed after conveying fertilizer.

OPERATOR SAFETY

The Kongskilde SUCB 500 was safe to operate as all rotating parts were well shielded. The intake nozzle was much safer to operate than a grain auger since there was no exposed flighting or rotating parts. Working near the intake nozzle was virtually dust-free since most dust was conveyed into the inlet. Working near the discharge cyclone was, however, very dusty.

Noise levels[2] near the Kongskilde SUCB 500 when powered with an 80 kW (107 hp) tractor varied from 93 to 98 dBA when operating on flat open fields. Noise levels when operating near metal bins, or in enclosed areas, became very loud and irritating. It is recommended that an operator wear suitable ear protection when working near the Kongskilde SUCB 500.

The Kongskilde SUCB 500 in transport position was low enough to pass safely under power lines. Its 1.8 m (5.9 ft) transport width allowed for safe road transport.
No slow moving vehicle sign was provided on the Kongskilde SUCB 500. It is recommended that the manufacturer supply a slow moving vehicle sign as standard equipment.

OPERATOR'S MANUAL

Assembly instructions and a complete parts list were provided. The operator's manual was, however, lacking in detailed information on operation, maintenance and safety. For example, there was no mention in the manual that the air regulator had to be in the start position when starting the unit. It is recommended that the manufacturer supply an operator's manual containing information on safety, operation, servicing, and adjustments of the Kongskilde SUCB 500.

MECHANICAL PROBLEMS

TABLE 4 outlines the mechanical history of the Kongskilde SUCB 500 during 21 hours of operation. The intent of the test was functional evaluation. The following mechanical problems-represent those, which occurred during functional testing. An extended durability evaluation was not conducted.

TABLE 4. Mechanical History

Item	Operating Hours
Piping	
-The elbow between the blower and the cyclone separator leaked air and was sealed using duct tape at	1
-A modified separator and elbow were supplied at	end of test
-The vinyl flexible clean-out hose started to collapse at	10

DISCUSSION OF MECHANICAL PROBLEMS

Piping: During initial field testing, it was noticed that the elbow between the blower and the separator cyclone was leaking air at its joints. The joints were only spot welded in a few locations. Several wraps of duct tape sealed the joints effectively (FIGURE 18). A modified separator cyclone and air tight elbow were supplied at the end of the test.

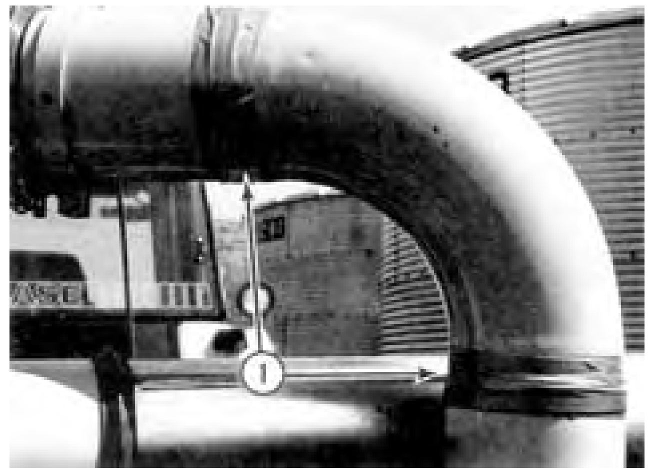


FIGURE 18. Leaking Pipe Elbow Joints: (1) Duct Tape Seal.

The vinyl flexible clean-out hose did not have the strength to withstand the pulsating action created by the conveyor. Although the flexible hose was still being used at the end of the test, it required replacing (FIGURE 19). It is recommended a more durable flexible clean-out hose be provided.


FIGURE 19. Collapsed Vinyl Flex Hose.

[2]*Machinery Institute T791, Detailed Test Procedures for Determination of Noise Levels from Stationary Processing Equipment.*

APPENDIX I
SPECIFICATIONS

MAKE:	Kongskilde
MODEL:	SUCB 500
SERIAL NUMBER:	1000 C42G
MANUFACTURER:	Kongskilde Limited P.O. Box 880 Thames Road East Exeter, Ontario N0M 1S0

DIMENSIONS:	Field Position	Transport Position
-- overall length	2900 mm	2920 mm
-- overall height	4700 mm	3250 mm
-- overall width	4680 mm	1800 mm
-- wheel tread	1635 mm	1635 mm

INTAKE AND DISCHARGE PIPES: 150 mm diameter
160 mm diameter flexible hose
160 mm diameter rigid pipe

	Length	Weight
FLEXIBLE PIPE:	4600 mm	5.8 kg
	2850 mm	15.0 kg
RIGID PIPE:	2000 mm	7.2 kg
	1000 mm	3.6 kg
	600 mm	2.4 kg
	300 mm	1.3 kg

INTAKE NOZZLE: 12.3 kg

CLEAN-OUT NOZZLE: 7.0 kg

	Maximum	Minimum
DISCHARGE HEIGHT:	3900 mm	2860 mm

REACH: 1730 mm

NUMBER OF LUBRICATION POINTS: 5 grease fittings, 8 - 40 hour service
2 seals, serviced seasonally

DRIVES:	
-- power take-off	540 rpm
-- fan drive	multi V-belt
-- air lock	multi V-belt

DISCHARGE CYCLONE:
-- weight 20 kg

TIRES: 2, tubeless, 5.60-15

WEIGHT:	Field Position	Transport Position
-- right wheel	114 kg	217 kg
-- left wheel	277 kg	89 kg
-- hitch	189 kg	215 kg
Total	580 kg	521 kg
CENTRE OF GRAVITY:		
-- above ground	628 mm	560 mm
-- forward of trailer axle	849 mm	1070 mm
-- in from left wheel	587 mm	1018 mm

OPTIONAL EQUIPMENT:
- -- 160 mm diameter galvanized pipe*
- -- clean-out nozzle*-150 mm diameter vinyl, wire reinforced, flexible hose - 4.6 m long.*
- -- 160 mm diameter rubber, wire reinforced, flexible hose - 2.8 m long.*

*supplied with test machine

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 meter (m)	= 3.3 feet (ft)
1 millimetre (mm)	= 0.04 inches (in)
11 tonne (t) = 1000 kilograms (kg)	= 2204.6 pounds (lb)
1 tonne per hour (t/h)	= 2204.6 pounds per hour (lb/h)
	= 96.74 bushel per hour (bu/h) for 60 lb/bu wheat
	= 45.93 bushel per hour (bu/h) for 48 lb/bu barley
	= 64.84 bushel per hour (bu/h) for 34 lb/bu oats
	= 44.09 bushel per hour (bu/h) for 50 lb/bu canola
1 kilowatt (kW)	= 1.34 horsepower (hp)
1 tonne per kilowatt hour (t/kWh)	= 27.42 bushel per horsepower hour (bu/hph) for 60 lb/bu wheat
	= 34.28 bushel per horsepower hour (bu/hph) for 48 lb/bu barley
	= 48.38 bushel per horsepower hour (bu/hph) for 34 lb/bu oats
	= 32.90 bushel per horsepower hour (bu/hph) for 50 lb/bu canola
1 kilometre/hour (km/h)	= 0.6 miles/hour (mph)

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