



Enriching Lives

# Owner's Manual for SVO Degumming Unit



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# **1 Introduction**

## ***1.1 Straight Vegetable Oil***

Straight Vegetable Oil (SVO) is an alternate fuel to the diesel engines. A standard petro diesel fuel engine can be run on SVO with apt modifications. Principally, the viscosity and surface tension of the SVO must be reduced by preheating it, to prevent poor atomization, incomplete combustion and carbonization which can damage the engine. One common solution is to add a heat exchanger, and an additional fuel tank for "normal" diesel fuel (petro-diesel or biodiesel) and a three way valve to switch between this additional tank and the main tank of SVO. The engine is started on diesel, switched over to vegetable oil as soon as it is warmed up and switched back to diesel shortly before being switched off to ensure that no vegetable oil remains in the engine or fuel lines when it is started from cold again. In case of a diesel engine with single SVO fuel tank, in addition to the modifications in engine, a simple refining of SVO is required before adding it into fuel tank.

## ***1.2 Need for SVO Refining / Degumming***

To minimize the maintenance cost and increase the engine life – Free Fatty Acids (FFAs) in SVO can have a detrimental effect on metals. Copper and its alloys, such as brass, are affected. Zinc and zinc-plating (galvanization) are stripped by FFA's and tin, lead, iron, and steel are affected too. Thus SVO refining is recommended in order

To prevent clogging of injectors and fuel lines – FFAs tend to form solids in SVO while undergoing auto-oxidation reaction at room temperature, which can block fuel injector and clog fuel line. The engine is extremely vulnerable to this in case of single SVO fuel tank, as some amount of SVO is retained in injectors and fuel line when the engine is stopped.

To improve cold starting of the engine – Elimination of FFA also improves viscosity of the SVO significantly which facilitates cold start of the engine.

To ensure consistent engine performance – Natural SVO, containing FFA is unstable at ambient temperature conditions. The physical and chemical properties of SVO keep changing gradually which adversely impact on engine operation performance.

## **2 Degumming unit**

### **2.1 Description**

SVO degumming unit is a reaction vessel made of stainless steel and insulated with glass wool and covered with aluminum cladding. The reaction vessel is fitted on MS stand & ladder is provided to access the vessel opening. A mechanical stirrer is suspended in the reaction vessel which is driven by and motor mounted on the top plate Motor is connected to stirrer shaft through two speed gear drives for changing the rotation speed of the stirrer. The top plate is also fitted with four coil type heaters. Lid is provided for the reaction vessel so as to avoid spillage from top and for protecting electrical connections from oil spillage.

### **2.2 System Components with Specifications & GA drawing**

- |                    |   |
|--------------------|---|
| 1. Reactor Vessel: | Stainless Steel, Single batch volume 250 liters       |
| 2. Lid:            | Stainless Steel lid for the reactor vessel            |
| 3. Outlet valve:   | Outlet valve at the bottom of the vessel              |
| 4. Insulation:     | Rockwool  |
| 5. Heater:         | 4kW, Single phase, controlled surface temperature     |
| 6. Stirring motor: | 0.3 kW, Three phase, AC motor, Geared two speed drive |

### **2.3 Dimension (mm)**

Without ladder: 937 (L) x 937 (W) X 1932 (H)

With ladder: 2107 (L) x 937 (W) X 1932 (H)

### **2.4 Gross Weight**

Without ladder: Approx. 200 kg

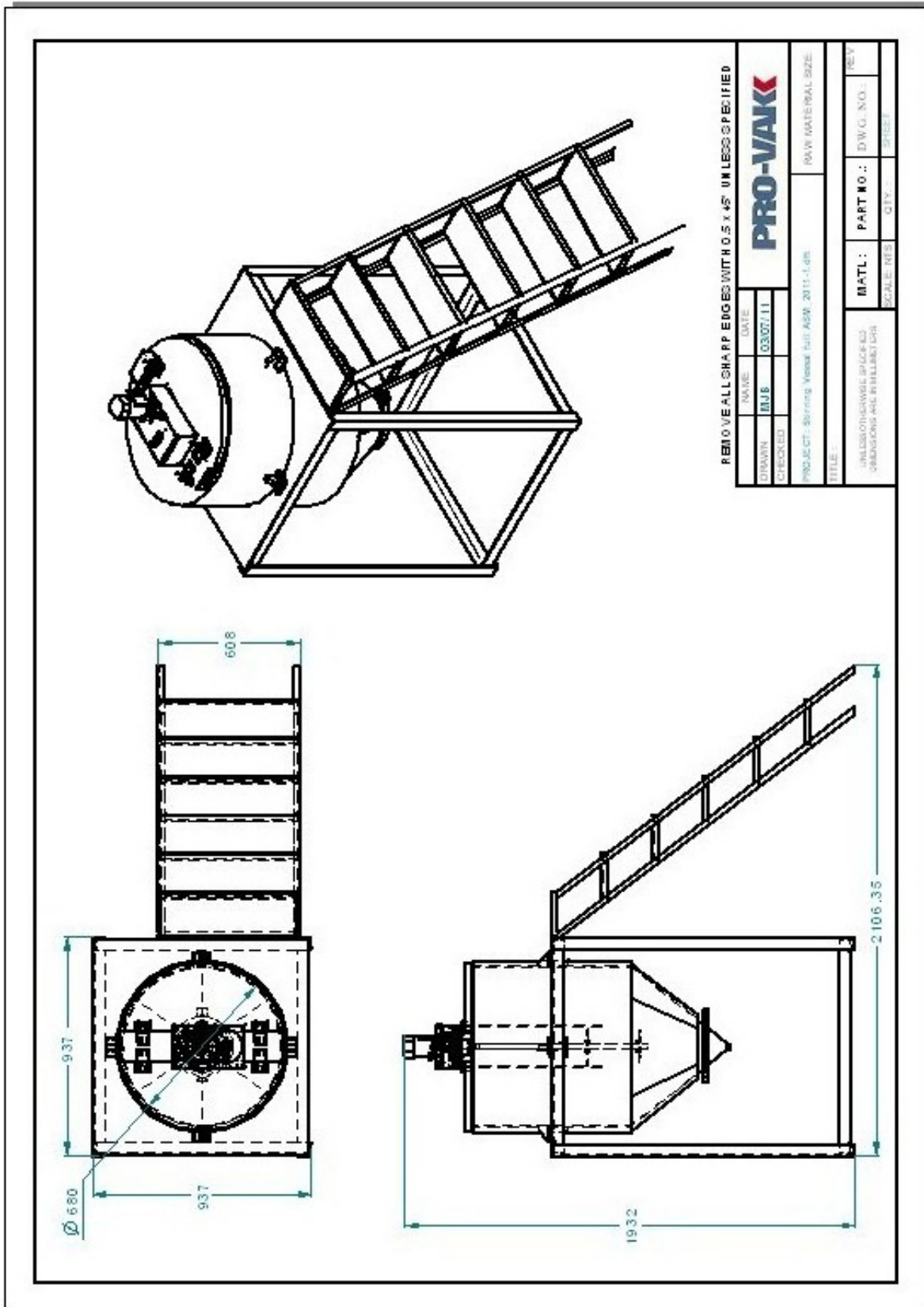
Weight of ladder: Approx. 50 kg

### **2.5 Consumables**

Ortho-Phosphoric acid of 85% strength, 3.5 lit/batch

Clean potable water, 15 lit/batch

## 2.6 GA drawing



### 3 Installation

Check following things while installation of degumming unit

1. Ensure proper assembly of the equipment as per the drawing
2. Ensure tightening of all the fittings
3. Check the system for the leakages using clean water
4. Attend the leakages & drain the water
5. Clean the vessel internally & externally with a clean cloth & ensure that it is completely dry
6. Electrical installation for heaters and motor
7. Ensure that the degumming unit is kept in proper shed with adequate ventilation.
8. Ensure that all the electrical connections are OFF
9. Ensure that the reaction vessel and the lid are clean and dry
10. Ensure that the outlet valve is closed
11. Ensure that the gear position is as per the desired stirring speed (For checking gear position refer following diagrams)

- Changing gear position from low speed to high speed

*For Changing low speed to High Speed  
Lift the lever Knob up and turn the lever  
at the position as shown in the fig 1  
Then Lift the Gear Knob and turn it at  
the position as shown in fig 2 and release  
it to engage the pin in the gear hole by  
adjusting the lower gear Position  
manually*

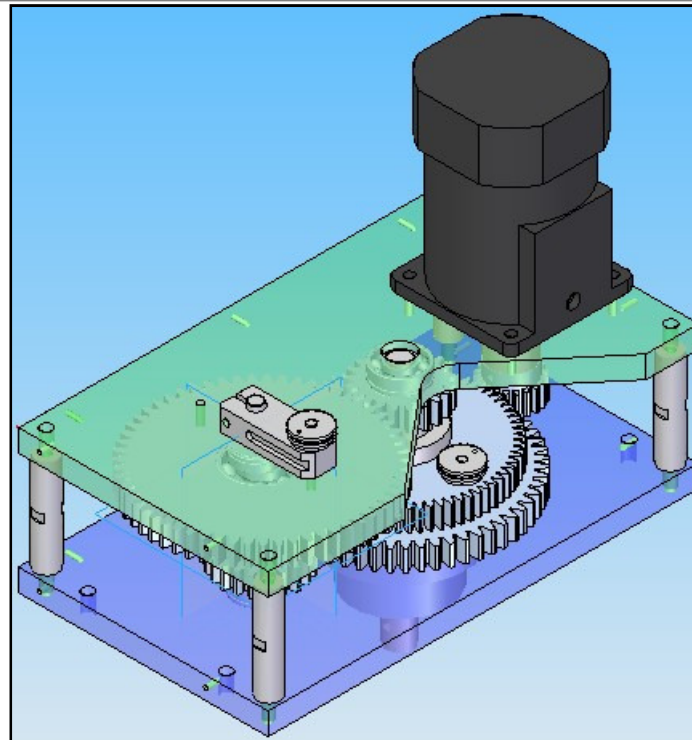
**Fig 1**  
Lever Knob  
Front Face  
Lever position towards Stair case  
B

**Fig 2**  
Pin position On Right side  
Gear Knob  
DETAIL B

**DETAIL A**  
No Gap  
No Gap

REMOVE ALL SHARP EDGES WITH 0.5 x 45° 0# UNLESS OTHERWISE SPECIFIED

NAME	DATE	PRO-VAKK	
DRAWN: BJB	01/22/11		
CHECKED:			
PROJECT: NTL_06 High speed position.dft		RAW MATERIAL SIZE:	
TITLE:			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS		MATL:	PART NO.:
		SCALE: 1:1	QTY:
		DWG. NO.:	REV:



- Changing gear position from high speed to low speed

**For Changing High Speed to Low Speed**  
**Lift the lever Knob up and turn the lever at the position as shown in fig.1**  
**Then Lift the Gear Knob and turn it at the position as shown in the Fig. 2 and release it to engage in the counter by Adjusting the lower gear position manually**

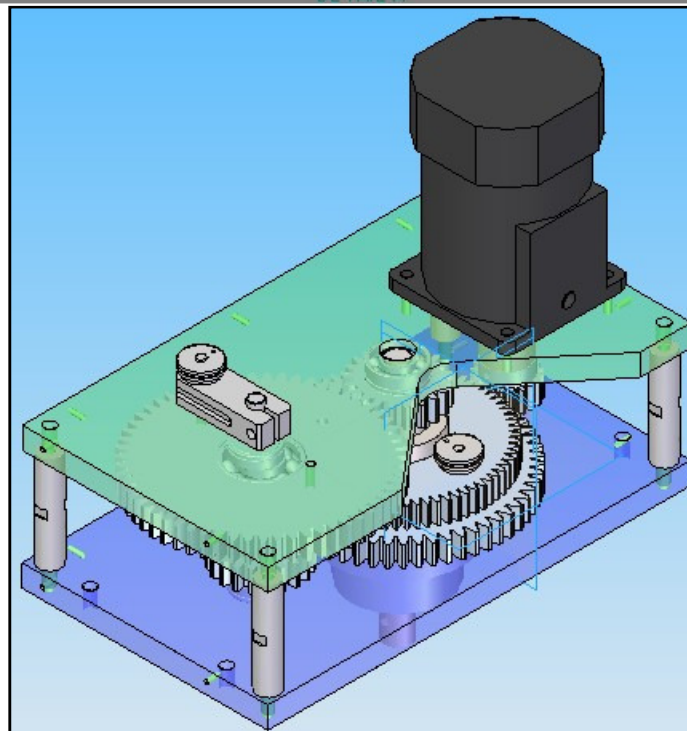
**Fig. 1**

**Fig. 2**

REMOVE ALL SHARP EDGES WITH 0.5 x 45° UNLESS SPECIFIED

NAME:	DATE:	<b>PRO-VAK</b>
DRAWN: HJE	03/07/11	
CHECKED:		
PROJECT: NTL - G B low speed position.dwg	RAW MATERIAL SIZE:	
TITLE:		
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS	MATL:	PART NO.:
SCALE: NTS	QTY:	DWG. NO.:
		REV:

DETAIL A



## 4 Operation

All SVOs derived from oil extraction of both the edible and non-edible oil seeds contain free fatty acids (FFA). At room temperature, FFAs tend to undergo auto-oxidation slow destructive reaction. During this reaction, the unwanted phenomenon of gradual change in physical and chemical properties of SVO takes place. In order to prevent auto-oxidation of SVO and improve its shelf life, FFAs are removed by refining the oil.

### 4.1 Principle

Oil is heated up to 75-80°C and Ortho-Phosphoric acid is added in to it at specified volumetric proportion. While the solution is stirred constantly for few hours at 80°C temperature, the Ortho-Phosphoric acid reacts with FFAs. Both stirring and heating is turned off and oil is allowed to settle at ambient temperature. The impurities in the form of phosphates and phospholipids settled at the bottom are then removed. The oil solution is again heated to 100°C and water washed to remove excess Ortho-Phosphoric acid. The water is distilled out and the remaining oil is again heated up to 100°C for few minutes to remove water traces by vaporization.

### 4.2 Procedure

In the present batch type oil refining process, a maximum 250 liters of oil can be refined in about 4-5 hours' time. Following is the procedure to be carried out for SVO degumming.

1. Take 250 liters of oil into the reactor vessel and heat up to 80°C
2. Slowly add 3.5 liters of Ortho-phosphoric acid to the oil
3. Stir vigorously for 5 minutes and then stir slowly for 1.5 hrs
4. Maintain the temp to 80°C while stirring
5. Stop the heating and stirring. Allow the impurities to settle down
6. After 45 minutes, remove the impurities from the mixture
7. Heat the oil to 100°C and slowly add about 10 - 15 liters clean water
8. Flash mix the entire mixture for 15 minutes
9. Allow layer separation for about 1 hr
10. Remove water layer form the reactor
11. Heat the oil to 100°C for 30 - 45 minutes with slow stirring
12. Stop heating and stirring. Collect the treated oil in storage tank

## **5 Maintenance**

### **5.1 Preventive routine maintenance**

1. Check for proper working of all the assembled components
2. Check all the nut-bolt joints of the degumming unit for proper tightening every quarter
3. Check for leakages from the valves or joints every week. In case of any leakage, rectify it immediately
4. Check cleanliness heater coils every day
5. Check tightness gears for alignments & working every day.
6. Clean the reaction vessel by using liquid soap every quarter
7. Remove clogging of valve if any. Check every fortnight.
8. Check for breakage of wiring every week

### **5.2 Do's & Don'ts**

#### **5.2.1 Do's**

1. Always wear safety (insulated and chemically inactive) gloves while operating the degumming unit
2. Always wear safety shoes while operating the degumming unit
3. Always wear safety glasses while operating the degumming unit
4. Follow the instructions given in the Material Safety Data Sheet while handling Ortho-phosphoric acid.

#### **5.2.2 Don'ts**

1. Never add the water to acid
2. Never handle acid without safety gloves
3. Do not drink oil and other chemicals
4. Do not use degummed oil for cooking
5. Do not put your hand in the reaction vessel while heating and stirring are ON
6. Don't allow heated oil and acid to come in contact with any of your body parts.

## 6 Material Safety Data Sheet (MSDS)

Section 1 Identification			
Product Name:	Phosphoric Acid 85% w/w Reagent A.C.S.	Health:	3
Trade/Chemical Synonyms		Flammability	0
Formula:	H <sup>+</sup> PO <sup>-</sup>	Reactivity	1
RTECS:	TB6300000	Hazard Rating:	
C.A.S	CAS# 7664-38-2	Least Slight Moderate High Extreme	
		0 1 2 3 4	
		NA = Not Applicable NE = Not Established	

Section 2 Component Mixture				
Component	CAS Number	%	Dim	Exposure Limits:
Phosphoric Acid 85% w/w	CAS# 7664-38-2	100%	V/V	TWA 1 mg/mf STEL 3mg/mf

**Section 3 Hazard Identification (Also see section 11)**

Causes severe irritation and burns. May be harmful if swallowed. Avoid breathing vapor or dust. Use with adequate ventilation. Avoid contact with eyes, skin, and clothes. Wash thoroughly after handling. Keep container closed.

**Section 4 First Aid Measures**

Causes severe irritation and burns. May be harmful if swallowed. Avoid breathing vapor or dust. Use with adequate ventilation. Avoid contact with eyes, skin, and clothes. Wash thoroughly after handling. Keep container closed.

FIRST AID: SKIN: Remove contaminated clothing. Wash exposed area with soap and water. If irritation persists, seek medical attention.

EYES: Wash eyes with plenty of water for at least 15 minutes, lifting lids occasionally. Seek Medical Aid.

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen

INGESTION: Give several glasses of milk or water. Vomiting may occur spontaneously, but DO NOT INDUCE! Never give anything by mouth to an unconscious person.

**Section 5 Fire Fighting Measures**

Fire Extinguisher Type: Water May be used to keep fire exposed containers cool.

Fire/Explosion Hazards: Can react with common metals to liberate flammable and potentially explosive hydrogen gas. May form hazardous fumes.

Fire Fighting Procedure: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and clothing.

### Section 6 Accidental Release Measures

Wear protective clothing and respiratory protection from mists. Dike spill with sand or clay to keep out of sewer system. Cover small spill with sodium bicarbonate or soda ash.

### Section 7 Handling and Storage

Store in a cool dry well-ventilated area. Keep away from heat and flame. Do not get in eyes, on skin, or on clothing.

### Section 8 Exposure Controls & Personal Protection

Respiratory Protection: NIOSH/MSHA-approved respirator

Ventilation: Mechanical:  Hand Protection: Neoprene or heavy rubber.  
Local Exhaust:  Eye Protection: Goggles and Face Shield

Other Protective Equipment: Wear appropriate clothing to prevent skin exposure. Maintain eye wash and safety shower.

### Section 9 Physical and Chemical Properties

Melting Point:	-70°F	Specific Gravity	1.69
Boiling Point:	300°F	Percent Volatile by Volume:	>99
Vapor Pressure:	6 mm Hg at 68°F	Evaporation Rate:	Information not available
Vapor Density:	3.4	Evaporation Standard:	
Solubility in Water:	Soluble	Auto ignition Temperature:	Information not available
Appearance and Odor:	Colorless, viscous liquid	Lower Flamm. Limit in Air:	Information not available
Flash Point:	N/A	Upper Flamm. Limit in Air:	Information not available

### Section 10 Stability and Reactivity Information

Stability: Stable Conditions to Avoid: Moisture  
Materials to Avoid:  
Metals, strong alkalis  
Hazardous Decomposition Products:  
Phosphorus compounds  
Hazardous Polymerization: Will Not Occur  
Condition to Avoid: None known

### Section 11 Additional Information

NOTE: The pH of this material is less than 1. Effects of overexposure: severe eye, skin, respiratory and digestive tract irritations and burns. Difficulty in breathing, pain, nausea, vomiting, bloody diarrhea, convulsions, collapse and death. Acute: may damage eye and cause blindness. Vapors may cause respiratory irritation and pulmonary edema. As little as 1 ml has caused DEATH if ingested. Chronic: dermatitis. Target organs: eyes and skin. Conditions aggravated/target organs. Persons with pre-existing eye, skin or respiratory conditions may be more susceptible.

DOT Classification: Phosphoric Acid, 8, UN1805, PG III



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