YOUNG

METEOROLOGICAL INSTRUMENTS

INSTRUCTIONS

PROPELLER ANEMOMETER

MODEL 27106T

CE

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PN: 27106T-90
REV: F062819

MODEL 27106T
GILL PROPELLER ANEMOMETER

SPECIFICATION SUMMARY

Range, Axial Flow:	0 to 40 m/s (90 mph)
Range, All Angles:	0 to 35 m/s (80 mph)
Propeller:	Ø 20cm 4-blade Carbon Fiber Thermoplastic (CFT) helicoid propeller
Pitch:	30.0 cm air passage per revolution
Distance Constant*:	2.1 m (6.9 ft.) for 63% recovery
Threshold Sensitivity*:	0.4 m/s (0.8 mph)
Signal Output:	Analog DC voltage proportional to axial wind component. Polarity reverses with reverse rotation. 1800 rpm (500 mV) = 9.0 m/s (20.1 mph).
Power Requirement:	Anemometer is self powered

(*Threshold and Distance Constant values are for axial flow.)

GENERAL

Operating Temp: -50 to 50°C (-58 to 122°F)

Specifications represent nominal values determined in accordance with ASTM standard procedures.

INTRODUCTION

The Gill Propeller Anemometer is a low threshold precision air velocity sensor employing a fast response helicoid propeller. The instrument uses a high quality tach-generator transducer which converts propeller rotation to a DC voltage that is linearly proportional to air velocity. The output signal is suitable for a wide range of signal translators and data logging devices.

Airflow from any direction may be measured, however, the propeller responds only to the component of the air flow which is parallel to the axis of its rotation. Off-axis response closely approximates a cosine curve (see accompanying graphs) with appropriate polarity. With perpendicular air flow the propeller does not rotate.

For detailed studies of low air speeds, optional propeller shaft extensions improve response in the 90° stall region by improving symmetry and reducing the stall angle.

The instrument mounts to 3/4 inch standard pipe. A rugged cable connector provides both electrical and mechanical connection. A dust cap is provided to protect the connector when the instrument is removed.

INITIAL CHECKOUT

When the instrument is unpacked it should be carefully checked for any signs of shipping damage. The propeller shaft should rotate easily without friction.

Using the WIRING DIAGRAM as a guide, connect the instrument to an oscilloscope or frequency meter and check for proper signals from the sensor. The calibration may be checked using the methods outlined in the CALIBRATION section of this manual.

INSTALLATION

Generally, the instrument should be oriented with the propeller facing the predominant flow of air being measured. In some cases it is appropriate to orient the instrument so the predominant air flow is perpendicular to the propeller such as in applications measuring the vertical component of wind. Keep in mind that off-axis response increases the effective threshold and distance constant. For vertical measurements mount the instrument so the propeller faces upward. This helps prevent moisture or dirt from entering around the propeller hub and potentially contaminating the bearings.

If the instrument is used to measure high air velocity or left for extended periods without attention, tape the threaded cable connector collar to eliminate the possibility of loosening from vibration. The threaded joint between the tach-generator and shaft housings may also be taped.

For some applications commutator ripple from the tach-generator may need to be reduced. Use a 500 uF 10 VDC non-polarized capacitor connected across the sensor leads as shown in the wiring diagram. Given the low internal resistance of the tach-generator the effective time constant of this filter is approximately 15 mS and will not degrade measurement accuracy to any significant degree.

The instrument measures both forward and reverse air flow. Signal polarity relative to the connection pins is shown in the wiring diagram. In applications measuring horizontal air flow, most users connect the sensor to produce a positive signal with flow from the front (counterclockwise propeller rotation). In applications measuring vertical air flow, the sensor is usually connected so downdrafts produce a negative signal, updrafts a positive signal.

Output from the tach-generator should be connected to a load impedance of 10k ohms or higher.

CALIBRATION

Calibration is determined by propeller pitch and the output characteristics of the tach-generator.

The Model 08254 Carbon Fiber Thermoplastic Propeller has a 30 cm/rev pitch. This is equivalent to 0.00500 m/s per rpm and is accurate to ±1%. Zero offset is insignificant. Formulas for other units of measurement appear on the calibration chart included with this manual.

The tach-generator output is set at the factory for 500 ±2 mV at 1800 rpm. Check the output by removing the propeller from the anemometer and coupling an Anemometer Drive to the shaft. Check linearity by taking measurements at several different speeds. If the tach-generator is out of calibration it must be replaced. See the following MAINTENANCE section for details on replacement procedure.

Information on checking bearing and transducer torque, which can affect propeller threshold, also appear in the MAINTENANCE section.

When the propeller is used for measuring vertical wind component, users may want to apply a 1.25 multiplier to the output signal. This may be done numerically in data processing operations or electronically in the signal conditioning. Using the multiplier brings the anemometer output signal within ±3% of the cosine response for elevation angles between -30 and +30 degrees. Since the standard deviation of wind elevation angle in open terrain rarely exceeds 12 degrees, 98% (2.5 standard deviations) of observations will be within ±30 degrees. Using the multiplier is NOT necessary when the anemometer is used in a UVW configuration with YOUNG Model 26800 Programmable Translator.

MAINTENANCE

Given proper care the Gill Propeller Anemometer should provide years of service. Components are conservatively rated and require little maintenance. The only parts likely to need replacement due to normal wear are the precision ball bearings and the tach-generator. The replacement procedures are best performed in a service facility and only by qualified technicians. If service facilities are not available return the instrument to the factory.

Refer to the accompanying drawings to become familiar with part names and locations.

FLANGE BEARING REPLACEMENT

If anemometer bearings become noisy or wind speed threshold increases above an acceptable level, bearings may need replacement. Check bearing condition using a Model 18310 Anemometer Bearing Torque Disk. If, after replacing bearings, the torque is still too high, check the tach-generator for any misalignment.

Replace bearings as follows:

1. REMOVE OLD BEARINGS
   a) Remove propeller from anemometer.
   b) Unthread and separate shaft housing assembly from generator housing.
   c) Loosen set screw on shaft collar/coupling disk and remove from propeller shaft.
   d) Slide propeller shaft through both bearings and out of housing.
   e) Pull front bearing dust shield off housing.
   f) Using the edge of a pocket knife, gently pry front and rear bearings out of housing.

2. INSTALL NEW BEARINGS
   a) Gently insert front bearing into housing.
   b) Push front bearing dust shield back onto housing.
   c) Carefully slide propeller shaft through front bearing and into housing.
   d) Slide rear bearing over propeller shaft and gently push it into housing.
   e) Place shaft collar/coupling disk on propeller shaft.
   f) Allow 0.010 inch (0.25 mm) end play gap between shaft collar/coupling disk and bearing. Tighten set screw (80 oz in, 5600 gm-cm max torque).
   9) Thread shaft housing assembly into generator housing. Tighten firmly.
   h) Check bearing torque to confirm it is within specifications.

TACH-GENERATOR REPLACEMENT

When the tach-generator output becomes erratic (usually due to brush failure) or begins to show signs of bearing failure (high torque), the entire generator assembly should be removed and replaced. If replacing the tach-generator due to excessive torque make certain it is indeed caused by a worn tach-generator, not the anemometer flange bearings.

Replace the tach-generator as follows:

1. REMOVE OLD GENERATOR ASSEMBLY
   a) Remove propeller from anemometer.
   b) Unthread generator housing collar. Pull generator housing away from sensor connector and generator assembly.
   c) Note position of generator wires on sensor connector pins. Unsolder wires from pins and remove old generator assembly.

2. INSTALL NEW GENERATOR ASSEMBLY
   a) Solder wires from new generator assembly onto proper sensor connector pins. Verify correct polarity: CCW rotation produces negative output voltage.
   b) Slide generator housing over generator assembly. Firmly tighten housing collar onto connector threads.
   c) Check bearing torque to confirm it is within specification.

WARRANTY

This product is warranted to be free of defects in materials and construction for a period of 12 months from date of initial purchase. Liability is limited to repair or replacement of defective item. A copy of the warranty policy may be obtained from R. M. Young Company.

CE COMPLIANCE

This product has been tested and shown to comply with European CE requirements for the EMC Directive. Please note that shielded cable must be used.

ADDITIONAL REFERENCES

References containing additional information about the Gill Propeller Anemometer are listed below in chronological order:

Holmes, R. M., Gill, G. C., and Carson, H. W., "A Propeller Type Vertical Anemometer", Journal of Applied Meteorology, Vol 3, 1964, pp. 802-804.

Drinkow, R., "A Solution to the Paired Gill-Anemometer Response Function", Journal of Applied Meteorology, Vol 11, 1972, pp. 7-80.

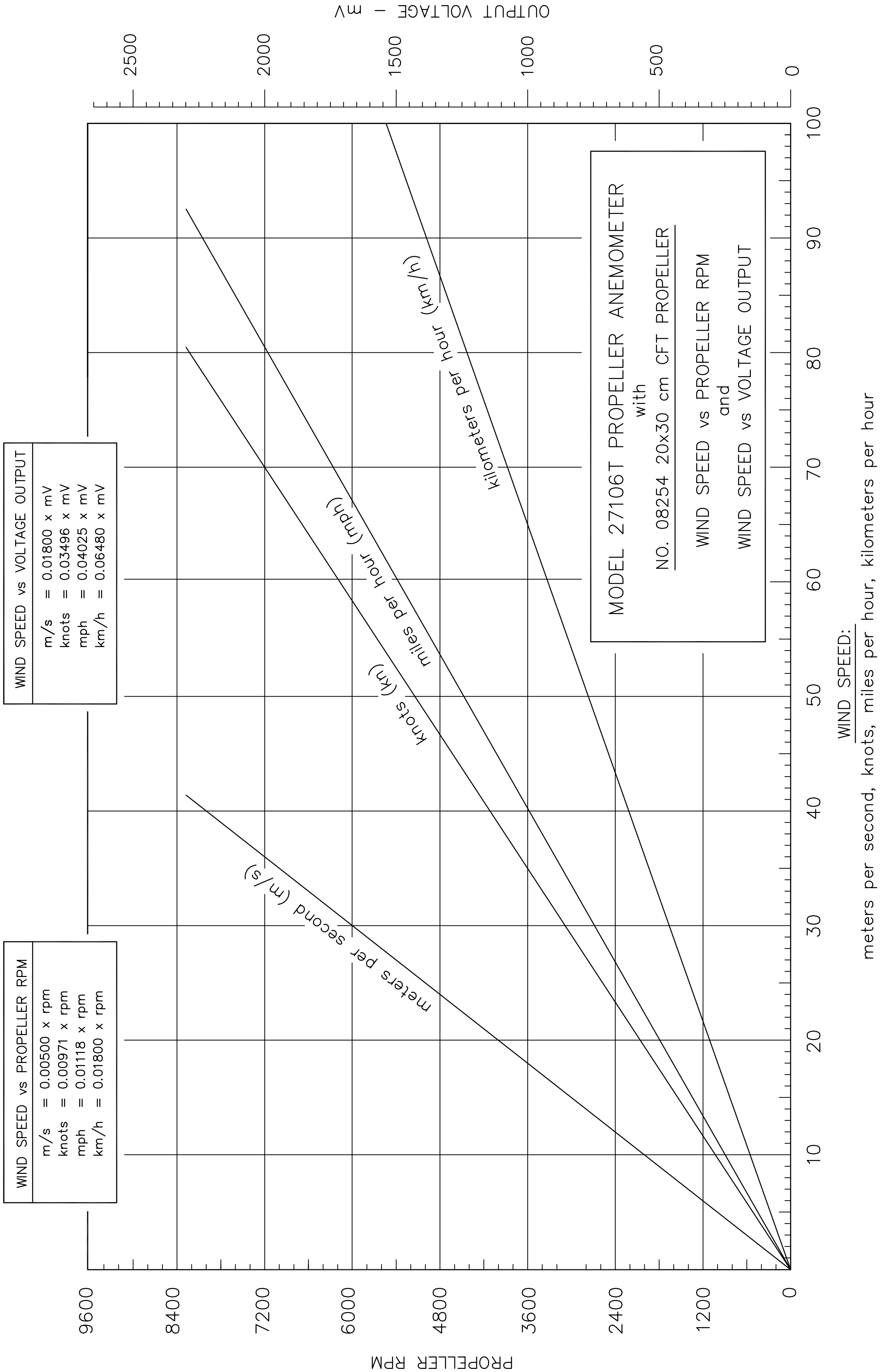
Hicks, B. B., "Propeller Anemometers as Sensors of Atmospheric Turbulence", Boundary-Layer Meteorology, Vol 3,1972, pp. 214-228.

Fichtl, G. H., and Kumar, P., "The Response of Propeller Anemometer to Turbulent Flow with the Mean Wind Vector Perpendicular to the Axis of Rotation", Boundary-Layer Meteorology, Vol 6,1974, pp. 363-379.

McMichael, J. M., and Klebanoff, P. S., "The Dynamic Response of Helicoid Anemometers", NBSIR 75-772, National Bureau of Standards, 1975.

PROPELLER CALIBRATION TABLE

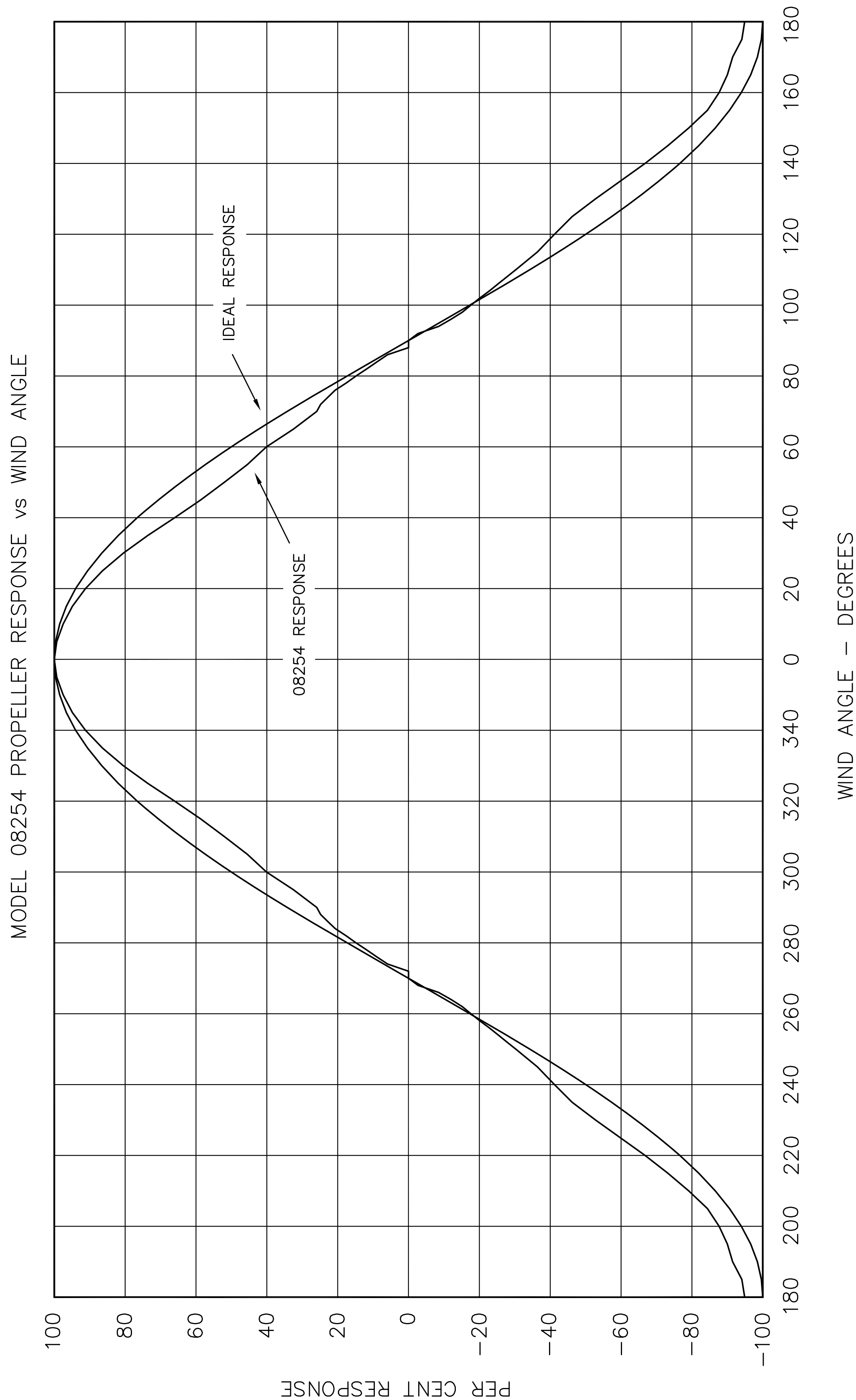
08254 PROPELLER



* INSTALL PROPELLER WITH SERIAL NO. FACING AWAY FROM THE SENSOR.

PROPELLER RESPONSE - WIND ANGLE

OFF AXIS RESPONSE DATA 08254 PROPELLER



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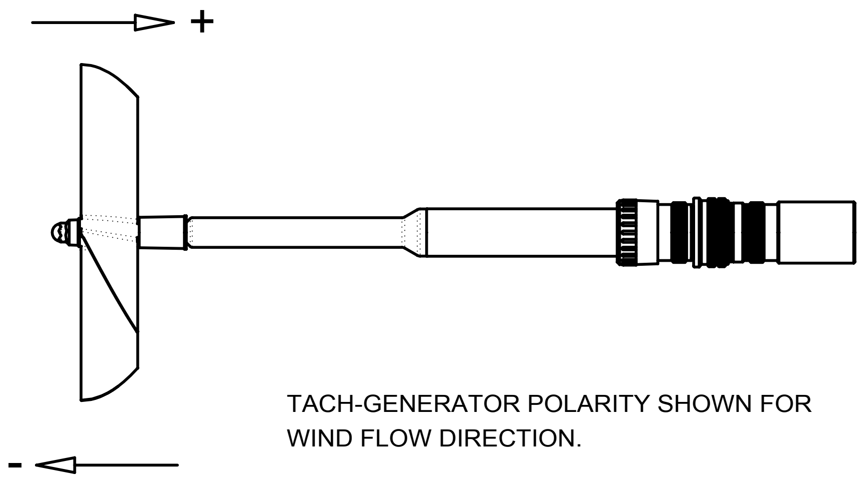
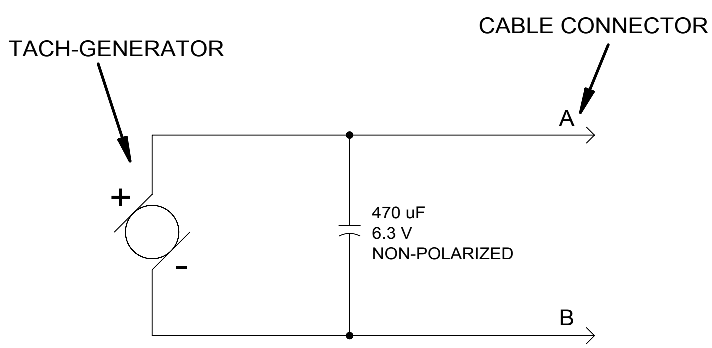
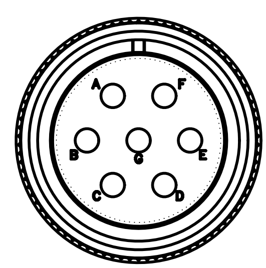
27106T CABLE CONNECTOR WIRING



TACH-GENERATOR POLARITY SHOWN FOR
WIND FLOW DIRECTION.

GENERATOR OUTPUT: 500 mV AT 1800 rpm
ARMATURE RESISTANCE: 32 OHMS





CABLE CONNECTOR / MOUNT
(PIN DESIGNATIONS)

27106T GENERAL ASSEMBLY & REPLACEMENT PARTS

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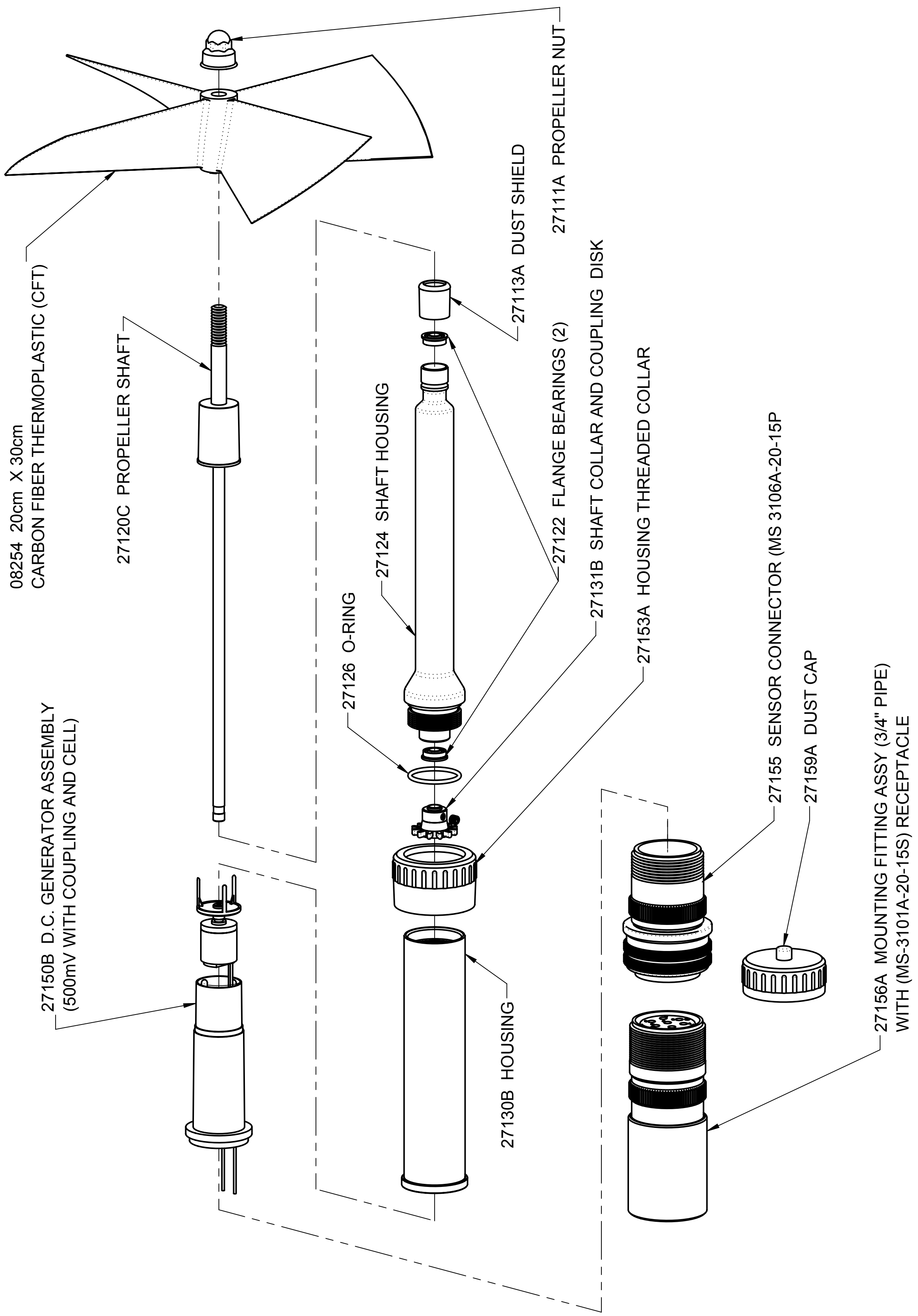

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