



MULTISTAR IND. INC. dba MULTIFROST

Quotation 220316ed

To: Del Masterhan
City of Homer AK

Note: Tank rental

Your Order #	Our Order #	Sales Rep.	FOB	Ship Via	Terms	Tax ID	Proposed
	220316ed	Esther Delgado			Net On Rec.		

Quantity	Item	Description	Dis-	Tax	Unit Price	Total
1	1000gl Tank	Empty Holds 4,400lbs			\$855.15 MO/ Applies 30 days after delivery.	\$1,710.30/ 1st month
	Ammonia Disposal					\$875.00
	Freight	Drop off & Pick up			\$425.00ea.	\$825.00
Subtotal Estimate						\$3,410.30
Tax						N/A
Miscellaneous						N/A
Balance Due						\$0

Quotation prepared by:

To accept this quotation, sign here and return:

Quotation valid for 30 days.

TEL 509.488.6601 • E- main@multistar-inc.com • FAX 509.488.6608





MULTISTAR IND. INC. dba MULTIFROST

Quotation 220316ed

To: Dan Masterhan
City of Homer AK

Note: Ammonia +/-4,400lbs

Your Order #	Our Order #	Sales Rep.	FOB	Ship Via	Terms	Tax ID	Proposed Ship-
	220316ed	Esther Delgado		Our truck	Net On Rec.		

Quantity	Item	Description	Discount	Taxa-	Unit Price	Total
+/-4,400	Anhydrous Ammonia				\$2.25lb	\$9,900.00
3	375gl. Tanks				\$331.50 each/mo.	Rental starts 30 days after delivery.
1	Freight- Pick Up					\$772.50
Subtotal Estimate						\$9,900.00
Tax						N/A
Miscellaneous						N/A
Balance Due						\$0

Quotation prepared by: Esther Delgado

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HPR Capacity Calculation

Note: Outside dimensions were used to ensure actual ammonia inventory is smaller than calculations.

Dimensions 35.5" wide by 209" long

Formula for area of a circle is $A = \pi r^2$

$$A = 3.1416 \times 17.75 \times 17.75$$

$$A = 989.8 \text{ in}^2$$

Formula for volume of a cylinder is Volume = Area X Length

$$V = 989.8 \times 209$$

$$V = 206,868.27 \text{ in}^2$$

$$V = 119.72 \text{ ft}^3$$

To err on the side of caution we'll round up

$$V = 120 \text{ ft}^3$$

To determine the number of pounds of liquefied ammonia the tank will hold when completely full, we multiply the weight of one cubic foot of liquid ammonia by the total volume. (Note: the refrigerant conversion chart referenced by <https://dec.alaska.gov/spar/ppr/prevention-preparedness/tier-ii-reporting/> does not appear accurate for ammonia. Therefore, I will use the tables provided by the Refrigeration Engineers and Technicians Association, a group dedicated to the education and professional development of America's refrigeration operators. In this way we follow Industry Standards as required by OSHA and EPA.)

At 70⁰ Fahrenheit, one cubic foot of liquid ammonia weighs 38.04 pounds. At 40⁰ Fahrenheit, one cubic foot of liquid ammonia weighs 39.52 pounds.

Total capacity @ 40⁰F = 4,742 pounds, @70⁰F = 4,564.8 pounds

Finally, Industry Standards state closed vessels should not be filled more than 80% full to avoid going over the prohibition against exceeding 85% capacity. (This allows the ammonia to expand if the temperature rises.) This gives a maximum storage capacity range of

3,793.6 @ 80% and 40⁰F., 3,651.8 @ 80% and 70⁰F (93.096 ft³ 696 gals 3679 lbs.)

4,030.7 @ 85% and 40⁰F., 3,880 @ 85% and 70⁰F

Note: We very seldom fill the HPR to the 80% mark.