ARCTIC TOWER CATENARY LOADING SYSTEM
TECH PROPOSAL

2022-05-26

DESIGN PURPOSE:

Products designation

Wire-framed oil-filling hoses, diam. 12 inches, intended for **operation under low temperatures (-50°C) and designed for up to 21 bar working pressure.**

Purpose

Designed to transport commercial oil, stable condensate, or a mixture thereof from the Terminal via two parallel lines through the end valve ("Pusnes" type) to the tanker under low temperature conditions

Shall provide for the hose connection to the other hose or connection piping and shall ensure securing of the flexible hose sections to the ends of the hose.

After checking the documents of tech request, we provide two design options:

Part A Design policy:

1). The flexibility and elasticity of the hose in a low temperature environment.
2). Has oil resistance.
3). Has sufficient tensile strength and bending stiffness.
4). The outer protective layer has low temperature resistance and logistics strength.

MAIN SPEC FERTURES:

Arctic Project Hose

1—Hose Type: End Enhanced (Oil Delivery Hose).

2—Hose ID x Length: 12ft x 35ft.

3—Rated working pressure: 21bar.

4—Description of the hose: supply end-enhanced oil transfer hose for tower terminal (ATTT) / tanker low temperature (oil transfer) operation in the Arctic region.

6—Specification of the oil hose: According to the requirements of the 209 edition standard, the burst pressure is more than 105bar. Follow the instructions in Drawings F and H.

7—The allowable axial load is 268KN. Follow the instructions in Drawing K.

8—Minimum bending radius: 1200mm.
9—Maximum (oil transfer) flow rate 15m/s.
10—Ambient temperature range: -50℃～52℃.
11—Product operating temperature range: -50℃～70℃.
12: Resistance to aromatic hydrocarbon content ~ 30%.
13—Inner sealing layer of oil hose: NBR/PUR rubber with excellent oil resistance and low temperature resistance.
14—Outer layer of oil hose: NBR/PUR rubber layer with excellent low temperature resistance and TPU elastomer casting type.
15—Conductivity: Continuous conductivity.
16: The inner diameter of the flange short joint of the hose is 302mm, and the inner diameter of the main pipe is 300mm.
17: Flange type ASME class: 300 lbs FF type.
18: Dimensional drawing sheet at the short flange joint.
19: The weight in the air is 1280kg/10.7m.
20: The weight in seawater filled with seawater is 460kg/10.7m (specific gravity of seawater is 1.03g/cm3).

Part B Hose design solutions-two options design

HOSE DESIGN OPTION 1—OIL RESISTANCE RUBBER AND LOW TEMPERATURE

1. Please refer to the drawing-12inch 21bar 40 feet length mainline hose;

A: Strengthen the binding of the wrapping polyester cord adhesive layer at the short flange section, use 316 cold-drawn stainless steel wire to tightly wrap and bind and fill the excess gap with low-temperature rubber.
B: An annular winding layer of 316 cold-drawn hard stainless steel wire with a length of 8 mm in diameter.
C: Weaving synthetic fiber threads with a large-diameter braiding machine.
D: Buffer layer formed by wrapping low temperature NBR/PUR alloy and polyester cord.
E: The NBR/PUR compounded rubber layer with excellent low temperature resistance, the rubber content is greater than or equal to 50%, and the rubber hardness is about 70 degrees of the sealing layer.
F: 2000dx3 polyester cord adhesive wrapping multiple layers. Reserve 2 to 3 meters of polyester cord at the short section, wrap and bind the reserved polyester cord tightly with 2mm stainless steel wire and stick to the outside of the hose in a left-to-right direction between the sub-layers. Improves bending stiffness and axial pullout force at hose pup joints. The bending stiffness and radial bearing effect of the hoses that F and H mainly act on, according to the calculated burst pressure>105bar.
G: The polyester cord is glued and wrapped with a low-temperature rubber cushion on the outside, which plays the role of bonding strength inside and outside the steel wire layer.
H: 316 stainless steel cold-drawn steel wire winding layer with a diameter of 8mm, the main function is to bear the radial pressure and the flexible ellipse of the hose.
I: The low-temperature rubber is extruded and filled with an extruder. buffering effect.
J: The same material and function of the G layer.
K: Multi-layer 2000dx3 polyester cords are glued and wrapped, reserve 3 to 4 meters in length at the short section, then bundle them tightly with 2mm stainless steel wire, and then the reserved polyester cords are left and right in turn on the hose. Externally, the purpose is bending stiffness and axial pull-out force at the sub. The design angle is conducive to the tensile strength. The theoretical breaking force of the design is more than 134 tons, and the allowable axial tension of the hose is 134 tons/5=26.8 tons.
L: After the low-temperature rubber is extruded and wound, it is steam vulcanized by tightly winding four layers of nylon tape.
M: Orange-red TPU material spin casting.

2. The fact of the hose specification:

1—Hose Type: End Enhanced (Oil Delivery Hose).
2—Hose ID x Length: 12ft x 35ft. 12ft x 40ft.
3—Rated working pressure: 21bar.

4—Description of the hose: supply end-enhanced oil transfer hose for tower terminal (ATTT) / tanker low temperature (oil transfer) operation in the Arctic region.
6—Specification of the oil hose: According to the requirements of the 209 edition standard, the burst pressure is more than 105bar. Follow the instructions in Drawings F and H.
7—The allowable axial load is 268KN. Follow the instructions in Drawing K.
8—Minimum bending radius: 1200mm.
9—Maximum (oil transfer) flow rate 15m/s.
10—Ambient temperature range: -50℃～52℃.
11—Product operating temperature range: -50℃～70℃.
12: Resistance to aromatic hydrocarbon content ~ 30%.
13—Inner sealing layer of oil hose: NBR/PUR rubber with excellent oil resistance and low temperature resistance.
14—Outer layer of oil hose: NBR/PUR rubber layer with excellent low temperature resistance and TPU elastomer casting type.
15—Conductivity: Continuous conductivity.
16: The inner diameter of the flange short joint of the hose is 302mm, and the inner diameter of the main pipe is 300mm.
17: Flange type ASME class: 300 lbs FF type.
18: Dimensional drawing sheet at the short flange joint.
19: The weight in the air is 1280kg/10.7m.
20: The weight in seawater filled with seawater is 460kg/10.7m (specific gravity of seawater is 1.03g/cm3).

HOSE DESIGN OPTION2-PTFE INNER LAYER HOSE(BEST FOR OIL RESISTANCE AND LOW TEMPERATURE)

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A: The flange short section of the polyester cord reinforcement layer is bundled with stainless steel wire with a diameter of 2mm.
B: The inner layer is a 1.1x71mm stainless steel tape (soft too) chain-lock armor structure, the lead is 19mm, and the axial free movement gap of the chain armor layer per turn is 2.2mm.
C: Aramid fiber yarn braided layer.
D: PTFE tape is wound with 0.1mmx100mm, the lead is 10mm, a total of three layers equal to thirty layers of sealing function. The PTFE material has excellent chemical resistance performance. Under

normal circumstances, the service life is 20 years, and the low temperature resistance is particularly excellent. -200 °C has an elongation of 5%, and the elongation at -50 °C is more than 180%. Aging resistant material. This layer is the sealing function layer.

E: Low temperature resistant rubber layer, which belongs to the second sealing function and has the function of buffering elasticity.

F: 2000dx3 polyester cord adhesive wrapping layer (the breaking force of each fiber line is about 430N) repeatedly wound six layers from left to right according to the design angle. Then reserve an extra 3 meters at the short joint and wrap it tightly with steel wire with a diameter of 2mm. The reserved polyester cords are pasted back on the hose in turn.

G: Cold-drawn hard stainless steel wire with a diameter of 8mm is annularly wound, and the lead is 34mm (see the drawing for the winding stroke). Layers F and G are mainly used to withstand radial pressure and bending stiffness, and also have some axial tensile functions.

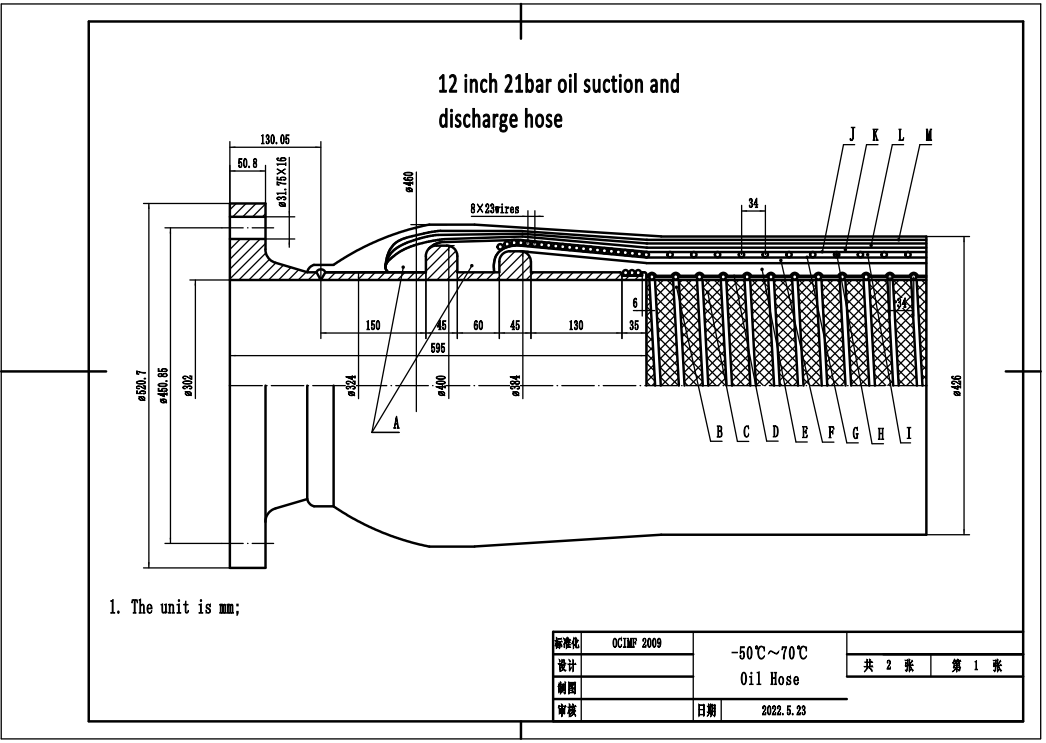
H: The low-temperature rubber is extruded and filled with an extruder, which has the functions of filling and buffering.

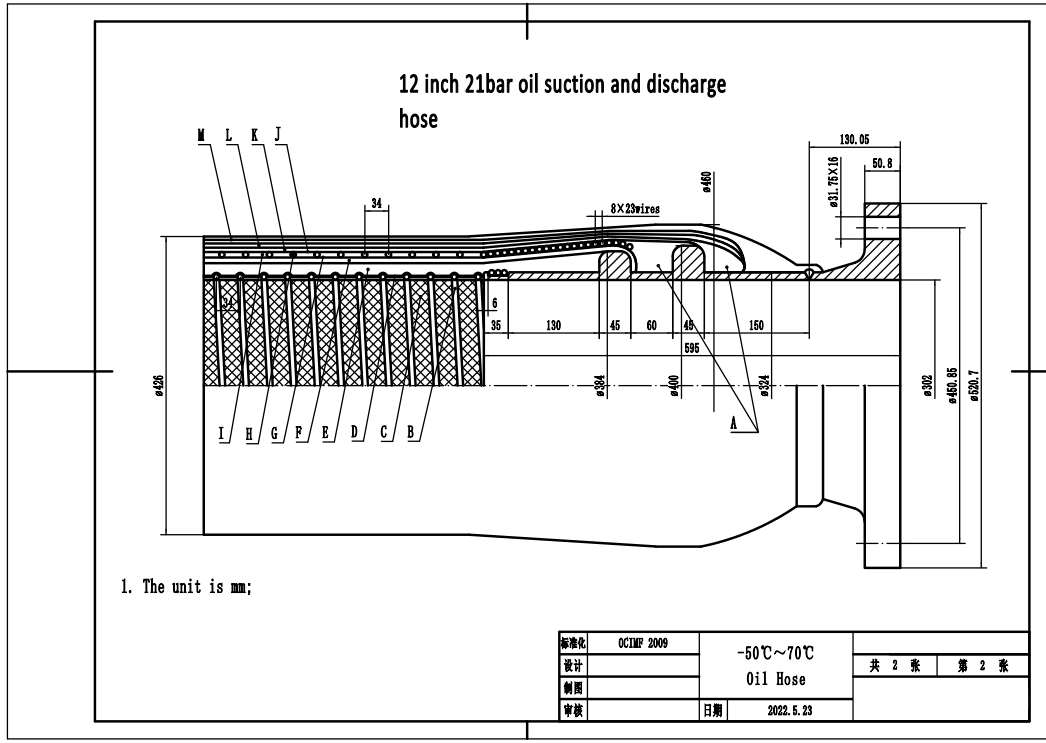
I: 2000dx3 polyester cord is glued and wound, and it is repeatedly wound from left to right for 10 layers to reserve 4 meters at the short section in turn. Stick it back on the hose. In this way, the resistance of bending stress at the short joint is improved, and this layer mainly bears the axial tensile force of the hose. The design breaking force is 134 tons of axial force, and the allowable axial tensile force of the hose is 26.8 tons.

J: The protective layer is extruded with low temperature rubber.

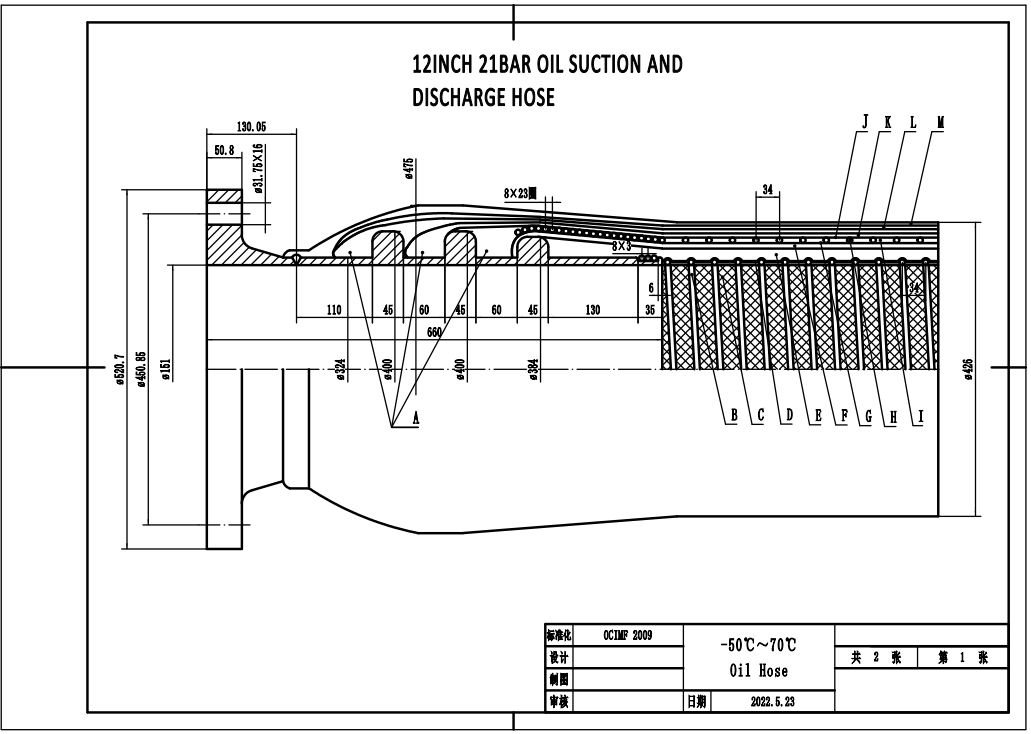
K: TPU elastomer spin casting molding.

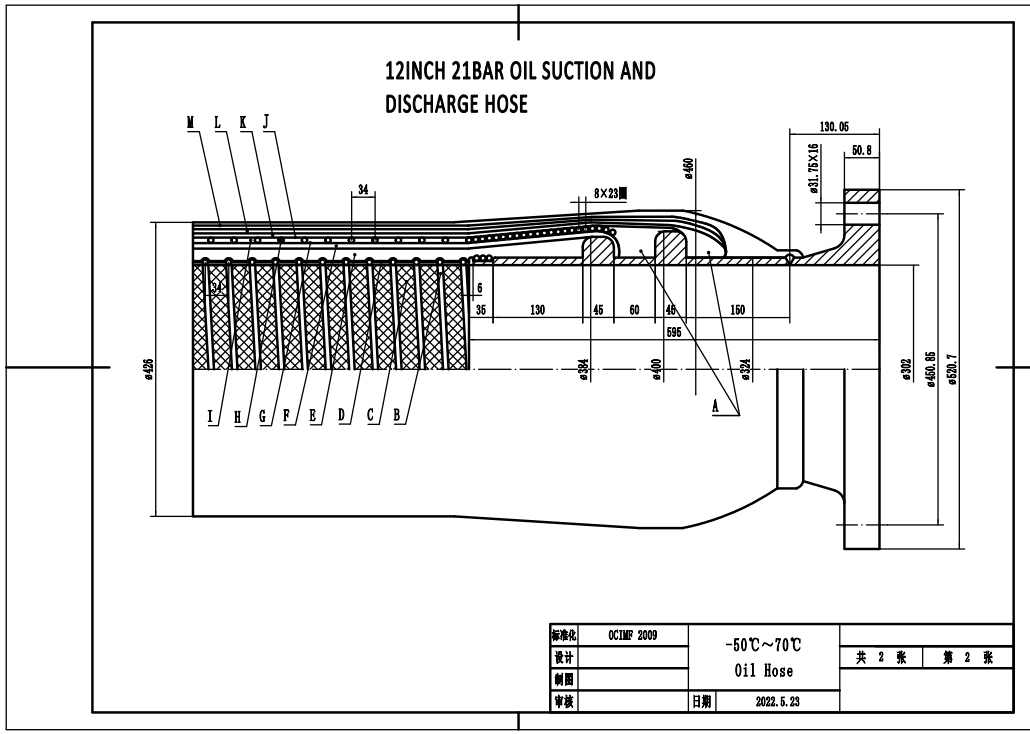
Hose option1:
The inner layer is -Oil resistance rubber
40FEET MAINLINE HOSES; EXCEPT THE
BOTH ENDS HOSES



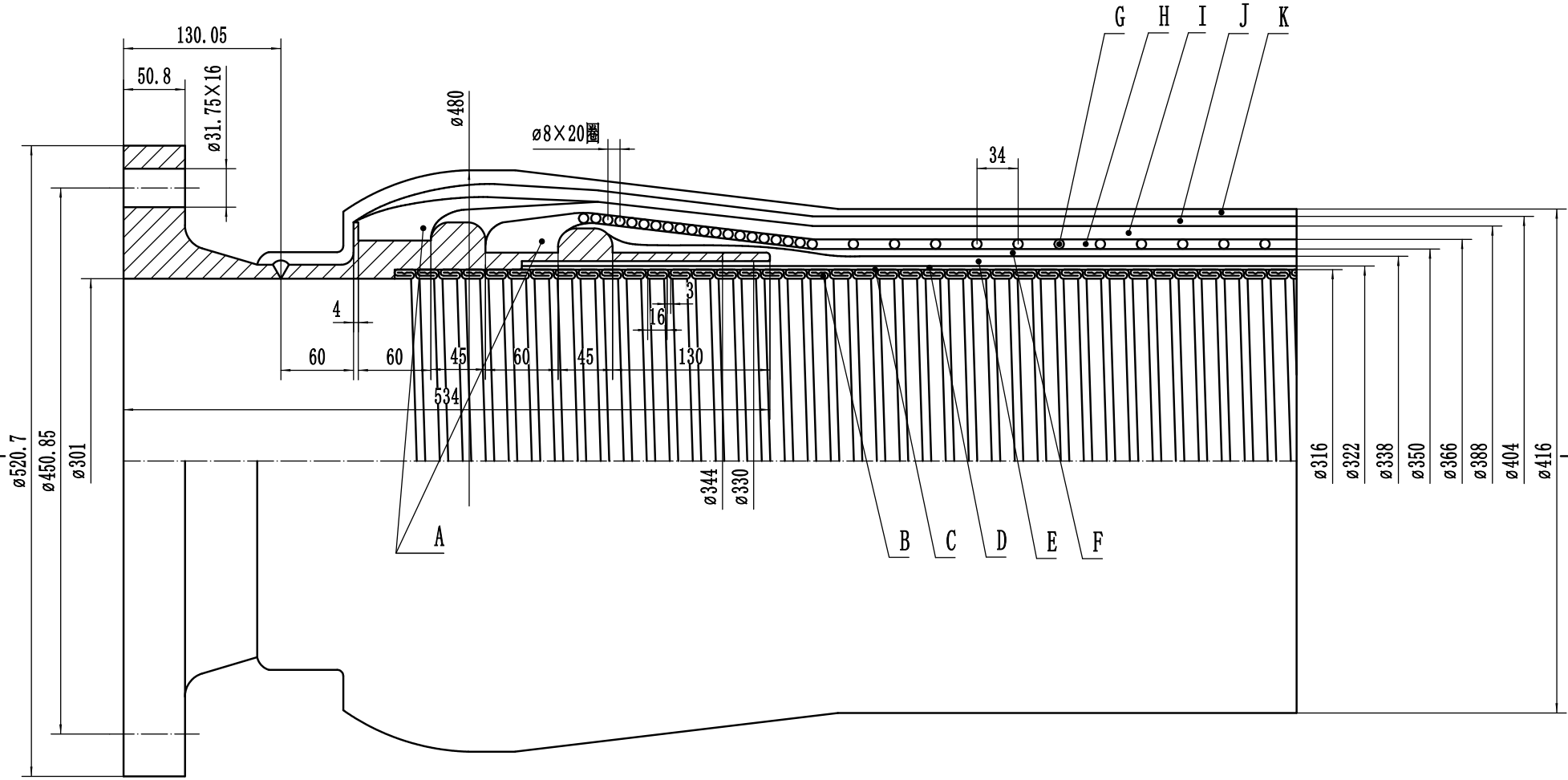


HOSE DESIGN OPTION 1-OIL RESISTANCE RUBBER OF INNER LAYER
35 FEET ONE END REINFORCEMENT-FOR THE BOTH ENDS USING OF TOTAL OIL HOSE LINE





12inch 21bar PTFE inner layer Hose



标准化	OCIMF 2009	-50℃～70℃ Oil Hose	
设计			共 2 张 第 1 张
制图			
审核		日期 2022.5.23	