

CLAIMS

What is claimed is:

1. A process for recovering propylene from a propane dehydrogenation (PDH) process comprising a PDH Reactor, the process comprising:
 - feeding dried process gas (1) from a Process Gas Dryer to a First Deethanizer Feed Chiller (20) and chilling it against propane;
 - sending the chilled dried process gas (2) to a First Deethanizer Feed Drum (22);
 - feeding liquid (4) from First Deethanizer Feed Drum (22) to a Deethanizer (24);
 - sending the overhead vapors from the First Deethanizer Feed Drum (22) to a Process Gas Compressor (PGC) (26);
 - cooling the discharge (3) from the PGC (26) against propane in a Second Deethanizer Feed Chiller (28), followed by propylene refrigerant in a Third Deethanizer Feed Chiller (30), and sending the discharge to a Second Deethanizer Feed Drum (32);
 - feeding liquid (6) from Second Deethanizer Feed Drum (32) to the Deethanizer (24);
 - chilling and partially condensing the vapor from the Second Deethanizer Feed Drum (32) in a Cold Box (34);
 - separating process effluent from the Cold Box (34) into vapor (7) and liquid phases in a First Cold Drum (36);
 - vaporizing liquid from the First Cold Drum (36) in the Cold Box (34) and recycling it to a first stage of the PGC (26);
 - reheating the vapor from First Cold Drum (36) to become a methane-rich tail gas product;
 - separating ethane and lighter components from C3 and heavier components in the Deethanizer (24);
 - partially condensing overhead vapor against Propylene refrigerant in an overhead Deethanizer Condenser (40);

separating process effluent from the overhead Deethanizer Condenser (40) into vapor and liquid phases in a Deethanizer Reflux Drum (42) and sending a vapor phase to Cold Box (34) and returning the liquid back to the Deethanizer (24);
feeding Deethanizer bottoms liquid (8) to a C3 Splitter; and
the Cold Box (34) superheating tail gas from First Cold Drum (36), a PGC Recycle stream (12), a C2 Rich Stream (11), and Propane feed to the PDH Reactor while also subcooling liquid propylene refrigerant.

2. The process of claim 1 further comprising reboiling deethanizer bottoms liquid against propylene refrigerant vapor in a Deethanizer Reboiler (38).
3. The process of claim 1 further comprising reboiling deethanizer bottoms liquid against quench water in a Deethanizer Reboiler (38).
4. The process of claim 1, 2, or 3 further comprising a pumparound on an upper section of the Deethanizer, which pumparound uses propane in a Deethanizer First Pumparound Cooler (46) and mid-level propylene refrigerant in a Deethanizer Second Pumparound Cooler (48) thereby reducing the requirement for low-level refrigerant on the overhead Deethanizer Condenser (40).
5. The process of claim 1, 2, or 3 further comprising feeding the deethanizer bottoms liquid (8) to a heat-pumped C3 Splitter and separating polymer-grade propylene from propane recycle and C4+ components.
6. The process of claim 5 further comprising returning the propane recycle to a Depropanizer and separating C4+ from fresh feed and propane recycle.

7. The process of claim 5 where a part of the propane recycle is taken as a side draw from the C3 Splitter that bypasses the Depropanizer.
8. A system for recovering propylene from a propane dehydrogenation (PDH) process comprising a PDH Reactor, the system comprising:
- a Process Gas Dryer configured to feed dried process gas (1) to a First Deethanizer Feed Chiller (20) and chill it against propane;
 - a First Deethanizer Feed Drum (22) configured to receive the dried process gas (2) from the First Deethanizer Feed Chiller (20);
 - a Deethanizer (24) configured to receive liquid (4) from the First Deethanizer Feed Drum (22);
 - a Process Gas Compressor (PGC) (26) configured to receive overhead vapors from the First Deethanizer Feed Drum (22);
 - a Second Deethanizer Feed Chiller (28) configured to cool discharge (3) from the PGC (26) against propane;
 - a Third Deethanizer Feed Chiller (30) configured to cool discharge from the PGC (26) with propylene refrigerant;
 - a Second Deethanizer Feed Drum (32) configured to receive discharge from the Third Deethanizer Feed Chiller (30) and to send feed liquid (6) to the Deethanizer (24);
 - a Cold Box (34) configured to receive, chill, and partially condense vapor from the Second Deethanizer Feed Drum (32);
 - a First Cold Drum (36) configured to separate process effluent from the Cold Box (34) into vapor and liquid phases and recycling vaporized liquid to a first stage of the PGC (26);
 - an overhead Deethanizer Condenser (40) configured to partially condense overhead vapor against Propylene refrigerant;
 - a Deethanizer Reflux Drum (42) configured to separate process effluent from the overhead Deethanizer Condenser (40) into vapor (7) and liquid, sending a vapor phase to the Cold Box (34);

a line (50) directing the liquid from the Deethanizer Reflux Drum (42) to the Deethanizer (24); and
a C3 Splitter configured to receive bottoms liquid (8) from the Deethanizer (24).

9. The system of claim 8 further comprising a Deethanizer Reboiler (38) configured to reboil deethanizer bottoms liquid against propylene refrigerant vapor.

10. The system of claim 8 further comprising a Deethanizer Reboiler (38) configured to reboil deethanizer bottoms liquid against quench water.