Oklahoma CareerTech Ground Source Heat Pump (GSHP) Initiative
To Prepare Service and Installation,
Troubleshooting and Repair Technicians
Equipment List, Vendors and Contact Information

For More Information: Jim Bullington
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Trade & Industrial Education
Oklahoma Department of Career and Technical Education
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Stillwater, OK 74074
405-743-5424
Jim.bullington@careertech.ok.gov
# Equipment, Vendor Contact and Price List

**Rev. 1.0 January 31, 2012**

**Rev. 1.1 February 24, 2012:**
- Clarified lengths and sizes on tubing and steel pipe
- Added Fine Print Notes from subsequent email
- Added McElroy Quote and notes

**Rev. 1.2 May 8, 2012:**
- Added resources for air sniffer valves

**Rev. 1.3 July 25 and August 21, 2012:**
- Updated ClimateMaster Quote for cost increase
- Added sources for pressure gauges, P/T port, P/T port adaptors, and Thermometers, as well as some minor equipment that’s very helpful as you put the station into operation

**Rev. 1.4 August 29, 2012:**
- Added fittings from ClimateMaster to complete connections from Flow Controller front and top to Purge Cart and Loop Cart, respectively
- Suggestion to order two carts and photo of GCTC GSHP on Cart

**Rev. 1.5 August 30, 2012:**
- Plan to secure practice HDPE pipe free on annual basis

**Rev. 1.6 November 14, 2012:**
- Rainmaker Sales quote on couplings

**Rev. 1.7 December 17, 2012:**
- Correct GeoEnterprise pricing

**Rev. 1.8 March 14, 2014:**
- Add photo of Radio Shack switches and updated McElroy contact. Clarified Stage 1-Stage 2 wiring.

**Rev. 1.9 October, 2015:**
- Updated contact info for GeoEnterprises, confirmed price quotes.
- Clarified preferred low voltage wiring/switching alternative to thermostat.

## Vendor/Equipment | Price Quote
---|---
**ClimateMaster** QUOTE NOT VALID UNTIL CONFIRMED/UPDATED 10/9/15
Contact: Raj Hiremath
Geothermal Application Manager
rhiremath@climatemaster.com
Phone (405) 745-6000 ext 347
Fax (405) 745-4102

**Ground Source Heat Pump** (List $ 6,195) (Valid until October 31, 2012) $ 1,809.00
- Tranquility 038 (TTV038AGC01ALKS, 3-ton vertical 27 EER 2-stage GSHP)
ClimateMaster, Inc.
7300 SW 44th Street
Oklahoma City, OK 73179

**Auxiliary Internal Electric Heat** $ 80.00
AGL10A, 10 kW (field installed): ClimateMaster

**Digital Multi-Stage Thermostat** $ 62.00
ATP32U03, 3-stage heating/ 2-stage cooling programmable thermostat: ClimateMaster
(This is a good price, but we didn’t actually use the thermostat at GCTC, see FPN at end)

**Flow Control Loop Pumping Module** $ 295.00

http://GSHP.okcareertech.org
Flow controller with bronze valves and UP26-99 circulator: ClimateMaster

**Connecting Kit (pump module to GSHP)** $59.00
AHK5EC: Hose connecting kit including double O-ring x 1” barb insert for connection to Flow Controller, 1” mpt x 1” barb insert ell with P/T port for connection to heat pump, and 10’ of 1” hose: ClimateMaster

**Adapters (pump module to Loop simulator and Flush Cart)** $40.00
AFC4C Double O-Ring x CamLock, 90 degree ell for the front, to connect to the Flush/Purge Cart, which comes WITH CamLocks, but the male CamLock has 1” MIP threads and won't fit into the Flow Controller (below, top right).

AFC4T Double O-Ring x 1” MIP adaptors for the top, to connect to the Loop Cart (below, 2nd from top left).

Since the MIP adaptors on the top will be pointed UP and would potentially put your hoses to the cart in a kink, I recommend these additional fittings, from Locke or other local vendor:
- 4-1” Brass ells
- 2-1” x 6” brass nipples

http://GSHP.okcareertech.org
2-1" MIP x 1" barbed adaptors (I'd recommend brass, since these may take some mechanical loading, and any steel we've introduced into the system has resulted in some oxidation and discoloring of the clear tubing.)

These fitting will allow for you to "u-turn" the MIP adaptors coming out the top of your Flow Controller and point it down so the hoses to the Loop Cart don't kink. The 6" nipples put the outer elbows out far enough to keep the downfacing barbed adaptors from interfering with operation of the 3-way valves on either side of the Flow Controller.

Mike Johnson at Indian Capital, Tahlequah chose to use the casters that came with his Little Giant cart on a larger cart he built and mount the Little Giant cart to it:

The “plugs” and blank cap shipped with the Flow Controller (left) are to use to seal the outlets to the Flush Cart when you are finished. We put the plugs in the top holes to keep debris out until we could finish connections to the Loop Cart. The “caps” for the 3-way valves are on the right. These items and the Double O-Ring x CamLock adaptor you might want to keep in your office with the other instruments until you have a student ready to work through the station. These I expect have a tendency to disappear.
**Vendor/Equipment**  
McElroy Manufacturing, Inc.

**Contact:**
Jim Johnston, Director of Industry Relations and Standards, [jjohnston@mcelroy.com](mailto:jjohnston@mcelroy.com)
Phone (918) 831-9253
Fax (918) 831-9285
P.O. Box 580550
Tulsa, Oklahoma 74158-0550

Not valid until confirmed/updated.

<table>
<thead>
<tr>
<th>HDPE Pipe Fusion Equipment</th>
<th>Price Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>A217201: 2LC Butt Fusion Splicer, up to 2” dies, Facer Blade Set, Digital Pyrometer Kit, and Storage Box:</td>
<td><strong>$ 1,959.26</strong></td>
</tr>
<tr>
<td>ASW19101: Socket Fusion Kit:</td>
<td><strong>1,035.00</strong></td>
</tr>
</tbody>
</table>

Layout of the adaptors in the molded plastic tray insert of the Socket Fusion Kit, left, and Brent Riner at the McElroy HDPE fusion training with 2LC Butt Fusion machine, right (rolling stand not included).

HDPE pipe for practice: Scott Munday of B&H Construction, LLC, of Goldsby has volunteered the B&H scrap yard for all the pipe of various diameters that we can use, so that we do not need to purchase full rolls. Since we only need pieces for fusion practice, and we can make a couple of 5’ pieces go a long way since each practice only consumes a couple of inches of the pipe. Contact contractors in your area to see about surplus “bits and pieces” of pipe left over from jobs they have done. I’ll continue to pick up scrap when I can and bring it to conferences.
Steve Stephens of IGSHPA will make a day trip to your program to guest present on HDPE pipe fusion. He can bring IGSHPA’s equipment, if necessary. Please have consumables (pipe and couplings) on hand (see below) for practice on butt- and socket-fusion.

Thomas.stephens@okstate.edu  
(405) 744-8217

Rainmaker Sales has quoted the following for HDPE couplings for practice socket fusion:

- ¾” – 0.91 ea
- 1” - 0.97 ea
- 1-1/4” – 1.17 ea
- 1-1/2” – 1.29 ea
- 2” – 1.38 ea

Josh Goodson  
Rainmaker Sales  
7251 Highway 177  
Shawnee, OK 74804  
josh@rainmakersales.us  
(405) 964-7575.  
Fax (405) 964-7585

<table>
<thead>
<tr>
<th>Vendor/Equipment</th>
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<tr>
<td>Geo-Enterprises</td>
<td></td>
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<tr>
<td>2640 N. Highway 167</td>
<td></td>
</tr>
<tr>
<td>Catoosa, OK 74015</td>
<td></td>
</tr>
<tr>
<td>Contact: John Clapp</td>
<td></td>
</tr>
<tr>
<td><a href="mailto:jclapp@geo-enterprises.com">jclapp@geo-enterprises.com</a></td>
<td></td>
</tr>
<tr>
<td>Phone: (918) 379-0193</td>
<td></td>
</tr>
<tr>
<td>Fax: (918) 379-0471</td>
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**Flush/Purge Cart**

“Pressure-Purge” Flush Cart (below left) $2100

Earth Loops ¾” X 410’ unicoil (3-205’ lengths with u-bend) with ¾” MIP brass fittings fused to each end, $157.66 each X3 (as mounted on cart, below right): $472.98
<table>
<thead>
<tr>
<th>Vendor/Equipment</th>
<th>Price Quote</th>
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<tbody>
<tr>
<td>Ewing Electric (WW Grainger dealer)</td>
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<tr>
<td>Contact: Doug Roberson</td>
<td></td>
</tr>
<tr>
<td>405-372-2078</td>
<td></td>
</tr>
<tr>
<td>1023 S Perkins Road</td>
<td></td>
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<tr>
<td>Stillwater, OK 74074</td>
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</table>

48" X 30" Platform Cart for pipe loops:
Little Giant Pipe Stake Truck

Quantity discount through Grainger

48" X 30" Platform Cart for pipe loops:
Little Giant Pipe Stake Truck

$330.00

NOTE: some programs have ordered TWO carts and put the GSHP on the second. Works out very well, as the width of the cart is exactly the same as the GSHP and allows securing the GSHP to the cart using the shipping brackets and some self-tapping screws, and the upright posts on each corner protect students and the equipment from each other (filter bracket, pump module, and service ells). See photo of Gordon Cooper Tech Center cart below.

Kee Klamp Side Outlet Elbows WW Grainger 4NXP9 (X4) and 90 degree Side Outlet Tees WW Grainger 4NXR1 (X4) (see images below and GCTC cart assembled, above right)

To connect lengths of 1" pipe to form cage on pipe stake truck to contain loops

$63 prox

2-Air sniffer valves x 1/8" MIP (see Header construction and additional fittings from local vendors, below)

Grainer 1X361

$6.14
The GSHP itself does not NEED to be on a cart, but DOES make the system more portable for stowing when not in use. If desired, a much lighter cart may be obtained locally at lower cost. See example photo of IGSHPA trainer below, left, and the Gordon Cooper Tech Center as-built cart, right. Pump module mounted, as shown, filter bracket is on opposite end, service (connection) elbows on left of photo.
Clear PVC pipe and fittings for Loop Cart Headers

Vendor/Equipment | Price Quote
--- | ---
US Plastic | $ 347.20

1390 Neubrecht Rd.
Lima Ohio, 45801-3196
1-800-809-4217

www.usplastic.com Harvel Clear Plastic pipe and fittings:

Clear PVC pipe and fittings to construct headers (shown suspended from top rails in loop cart photo above). Website says pipe sold in 10’ lengths but they will cut it to 5’ lengths for shipping. I have photos and dimensions to help simplify accurate reproduction of the IGSHPA headers shown.

<table>
<thead>
<tr>
<th>Quan</th>
<th>Part</th>
<th>Part Number</th>
<th>Cost/unit</th>
<th>Cost</th>
</tr>
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<tbody>
<tr>
<td>3.5</td>
<td>3/4&quot; Clear PVC Pipe</td>
<td>34103</td>
<td>2.35</td>
<td>8.23</td>
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<tr>
<td>4’</td>
<td>1-1/2&quot; Clear PVC Pipe</td>
<td>34106</td>
<td>5.59</td>
<td>22.36</td>
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<tr>
<td>6</td>
<td>3/4&quot; X 1&quot; bushing</td>
<td>34280</td>
<td>11.57</td>
<td>69.42</td>
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<tr>
<td>6</td>
<td>1&quot; X 1-1/2&quot; bushing</td>
<td>34282</td>
<td>16.15</td>
<td>96.90</td>
</tr>
<tr>
<td>2</td>
<td>3/4&quot; ell</td>
<td>34201</td>
<td>6.70</td>
<td>13.40</td>
</tr>
<tr>
<td>2</td>
<td>1-1/2&quot; ell</td>
<td>34204</td>
<td>22.63</td>
<td>45.26</td>
</tr>
<tr>
<td>2</td>
<td>3/4&quot; tee</td>
<td>34219</td>
<td>8.61</td>
<td>17.22</td>
</tr>
<tr>
<td>2</td>
<td>1-1/2&quot; tee</td>
<td>34222</td>
<td>30.29</td>
<td>60.58</td>
</tr>
<tr>
<td>1</td>
<td>1-1/2&quot; coupling</td>
<td>34213</td>
<td>13.83</td>
<td>13.83</td>
</tr>
<tr>
<td></td>
<td>Total per system</td>
<td></td>
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<td>347.20</td>
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In addition, from local vendors: add to GSHP side of each header (at suggestion of Dr. Jim Bose, validated by my experience) a provision to inject air under pressure. This allows demonstration during flushing/purging to observe the flow of air through the correctly constructed header versus the incorrectly constructed header. This process is difficult and time consuming to replicate without this simple addition.

2-3/4" PVC tees (Locke Supply R0331)

2-3/4” PVC pipe 3” long ("nipples" to slip clear tubing over)

2-3/4" slip x ¼" FIP PVC bushings (Locke Supply R0370 is ¾ x ½ slip x slip; R0404 is ½ x ¼ slip x FIP) (I also had to buy 2 Locke Supply F0200 ¼ x 1/8 galvanized steel bushings, as the sniffer valves I got from Grainger were 1/8”)

2-1/4” or 1/8” MIP “Brady” Sniffer Air Valve (Shown below in Grainger catalog [item 1X361] and a competitor)

This may be ordered at the time you order your Loop Cart from Grainger.
Snifter valve installed on return header, 1 of 2, above right.

<table>
<thead>
<tr>
<th>Vendor/Equipment</th>
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<tbody>
<tr>
<td>Local vendor:</td>
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<tr>
<td>1” nominal steel pipe, cut list:</td>
<td></td>
</tr>
<tr>
<td>4-60” lengths for uprights each corner</td>
<td></td>
</tr>
<tr>
<td>4-50” (prox) lengths for side center and top rails (lengths vary due to mfg variation in socket welding on cart)</td>
<td></td>
</tr>
<tr>
<td>4-27” (prox) lengths cut from stakes included with cart for end center and top rails</td>
<td></td>
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<tr>
<td>You will need about 37’ or 38’ of pipe for the 8 pieces above.</td>
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Clear tubing, valves, etc. to facilitate connecting HDPE coils to headers and isolate coils to simulate problems:

6--Clear tubing 1.315 OD x 1.05 ID (connect header to loops). This appears to be nominal 1” tubing based on specs I found at [http://flexpvc.com/PVCClearBraidedHoseSpecs.shtml](http://flexpvc.com/PVCClearBraidedHoseSpecs.shtml) of 1” ID and 1-5/16” OD, about 1.3125”. I would get this from local Lowes, Home Depot, or hardware store.

These are approximate lengths of the 6 pieces on IGSHPA’s loop cart using simple 500 foot coils. Since we are purchasing U-bends the lengths may be significantly different.

- 5’-6”
- 4’-6”
- 4’-6”
- 4’-6”
- 2’-6”
- 2’-0”

6-- 3/4” B&K CPVC Ball valves
6--3/4” MIP X 1” barbed gray PVC hose fittings
12 hose clamps

To connect Loop Cart headers to Pump Module:
2--Clear tubing 1.315 OD x 1.05 ID (Length as required, typically 2 X 10’ or so)

**Instrumentation to verify or troubleshoot loops:**

[http://GSHP.okcareertech.org](http://GSHP.okcareertech.org)
Pressure gauge
W.W. Grainger
4FFN2 $25.40

Pressure/Temperature (P/T) Test Plug (a.k.a., Pete’s Port)
P/T Port adaptor for Gauge
Federal Corporation (800-289-3031 OKC or 800-955-1918 Tulsa)
Adaptor (adds the “basketball filler” needle to the gauge): Part number
GA8002 (Part name 1/4” gauge adaptor with case)
Pressure/Temperature Ports (at least 2 needed if not included with your
GSHP): Part number PTB (Part name ¼” plug and cap) (see illustration at
right).

Digital insertion-type thermometer
Food coloring to simulate anti-freeze
5 gallon buckets (Lowes) to pre-mix anti-freeze
Short garden hose/ washing machine hose for FP Cart discharge, if near
a floor drain (a VERY good idea)
Silicone plumbers grease to lube thermometer and pressure gauge
before inserting into P/T ports
Slotted screwdriver to loosen cap on circulator pump (last step of flushing; releases air trapped
in wet shaft of motor)

From Lowe’s: Kobalt 1-7/8” Metal Poly Tube Cutter (131394, $13.68) makes quick work of all the
hose, tubing, and pipe you need to cut for this project.

End Notes

I’ve tried to accurately capture everything needed to fully equip this station. Any missing items
are unintentional and should be very minor valves, fittings, or pipe involving minimal extra
expense. I am glad to make a trip to help with assembly where details are not clear. I have
extensive photos, notes and drawings to help as well.

Please contact me with your questions or concerns. With the Federal tax credit for homeowners
to install these systems, the new public awareness and interest in “green” building, contractor

http://GSHP.okcareertech.org
need for trained technicians, coupled with the substantial discounts offered above, this is a very timely opportunity to add this training to your HVAC program.

I am working on the text materials for a 30-hour course to go with this equipment to help insure that your students leave with at least an awareness of and hands-on experience with GSHP equipment, prepared to impress a prospective employer.

Fine Print Notes from subsequent email elaborating on equipment construction
None of this is to imply that this list is all or nothing. Each of these deals is individual with the vendors shown. If you already have some of the equipment, you may acquire carte blanche. The loop cart may also be built with standard plumbing fittings and threaded pipe, though it may require some ingenuity without using unions, or it may be welded. I only suggest the Kee Klamp fittings as a quick and attractive method to save labor. Please don't scrimp on the cart. The weight of the loops and water is substantial (near 500 lbs.) and the potential for having part of that weight fall on someone is present if the cart and cage are not solidly and substantially built.

I'm told there are cheaper purge carts. The flush cart specified is made in Catoosa by our pipe vendor and they have had price increases that prevent them from further discounting them. DO look for one that allows you to pre-fill the pump and pre-purge loops with potable water system pressure. (See the slick ClimateMaster videos at http://airproductsupply.com/tutorials.html . Thanks, Robert Young for sharing those). Also look for tee at bottom of return pipe into tank to help dissipate returning bubbles; the ability to reverse flow to shock air out; and a couple of full-flow ball valves at the end of your purging hoses (where they connect to the pump module) to be able to contain fluid when you disconnect.

Notes included with pdf of McElroy Quote attached
The quote McElroy gave us is attached for your information and use when ordering. Notes:
Ignore the bottom line ($4273.68) as it includes TWO butt fusers: the 1LC and the 2LC. The 2LC is what you want, along with the accessories (pipe size inserts, facer blade set, pyrometer, and storage box) AND the complete Socket Fusion tool set.

A pic of Yadon's is below. He used TWO sets of the AFC4C CamLocks, and put a set of CamLocks on both his existing ground loop heat exchanger (GSHEX) AND Loop Cart, so he could switch back and forth. The CamLock in the foreground is the connection to his Loop Cart/Ground GSHEX.
We mounted Jerry’s Flow Controller exactly as you can see Steve’s, on the side of the unit opposite the filter. Note how Steve routed the LiquidTite from the circulator pump to the cabinet.

Tony, left, and Slaton making connections to Jerry’s GSHP.

Thermostat: we didn’t use the ClimateMaster stat as were concerned about the 5 min time delay, and may already be a delay on the CXS board, but it can be defeated by shorting a couple pins briefly. At Shawnee, we used the old IGSHPA example of handybox and double toggle switches, but that doesn’t take advantage of the two-speed compressor, so another method was needed. On the new IGSHPA trainer, we used three SPST rocker switches we found at Radio Shack (Model #: 275-693, Catalog #: 2750693, $3.49) (below), that are low profile, very attractive, and mount in a simple ¾” round hole. We mounted them in the blower compartment in the right upright part of the frame and fished the wiring down the column to the control panel. Steve had nice engraved labels made for “Run-Stop” “Heat-Cool” and “Stage 1-Stage 2”. 

http://GSHP.okcareertech.org
230 V wiring from the circulator pump goes to the two lugs on the left side of the wiring box. It is labeled for the desuperheater pump, and does run that pump, through a limit, but is breakerered through 2-7 amp breakers back to T1 and T2 on the contactor, and is live whenever the compressor runs.

Maybe this will help as you make final connections. I'm still available to come by and help if you want. May ask for some students with less arthritis than I have to do the heavy lifting. Just let me know.

Oklahoma Department of CareerTech
Trade and Industrial Education
1500 West Seventh Avenue
Stillwater, OK 74074
(405) 743-5424
Jim.bullington@careertech.ok.gov