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Alberta News

GREENHOUSE TIPS

Combat the high cost of heating.

Double Poly_2

ENERGY CONSERVATION SERIES - DOUBLE POLY CLADDING

Is a great cladding system when all things are good. If things not good, a nose bleed.

We received some feed back from our Dec. 2007, issue Double Poly_2 asking for some comparison charts and how R-values are predicted.

R values of assemblies

The resistance to heat flow through building components such as roofs, walls etc. is equal to the numerical sum of the resistances of all the parts and components of the assembly added in series. As an example R = R1 + R2 + R3 .... Rn . It should be noted the higher the sum of the R value is, the higher the thermal resistance the assembly has. In simple form ... the less the heat loss or gain.

The overall calculation to predict the amount of heat loss, over a temperature differential involves the use of the U valve, which is basically just the reciprocal of of R valve (1/R).

As an example. There are 1000 sq. ft. (A) of exposed wall area. It is 70 deg. F inside (Ti). It is -15 deg. F outside (To)and the wall assembly has an R valve of 8 (R).

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Energy Conservation

Should be your first step in reducing your energy operation costs.

This is what the hourly conducted heat loss would be for every hour at the above conditions.

Loss = A X (1/R) X (Ti-To)

Loss = 1000 sq. ft. X 1/8 X (70-(-15))

Loss = 10,625 BTU's / hour.

A note should be made this is only the conducted loss of the assembly and does not include items such as infiltration.

Double Poly

Item	**R value**
Outdoor Air Film	0.17
Outer poly	0.03
Dead Air Space	1.07
Inner Poly	0.03
Inside Air Film	0.61
R value of assembly	1.91
U value of Assembly	0.52

Back to how a R value of an assembly is calculated. The chart below indicates how the overall (best) thermal R value for double poly would be arrived. Notice there are five individual components used to calculate the assembly R value. There is the outside air film (which in this example we considered a 15 mph wind) , the outer layer of poly, the dead air space, the inner layer of poly and the inside air film. All of these items are added together for the assembly R valve of 1.91 (at its best). The U valve of the assembly which is 1/R which would be 0.52. For design purposes we allow use a min. U valve of 0.55 for double poly. By now you should have realized how little it takes to drastically effect the thermal performance of double poly, so be safe add some safety.

The following pages are a few spread sheet pages that pretty well indicate what has been said here.

POLY STATE TOOL

Hope you haven't forgot this little tool.

R1/R2=(Ti-Tx)/(Ti-To)

Where R1= inside air film
Where R2 = R value of assembly.
(And R = 1/U)
Ti is indoor temperature in deg. F
To is outdoor temperature in deg. F
Tx is the inside surface temperature of the assembly.

See the following pages for more.

TiD bit of Information

Bedding plant growers/tomato growers etc. etc. think they have it rough. How about the tree seedling silver culture growers ? Most located way up in Northern Alberta. Start their crops in January. Lots of -40 deg. F or C conditions and they are busy germinating crop. And quite successfully we must say. They indeed face challenges that most can only dream about. Even in the early 1990's they took their structure operational costs seriously.

Ratty Old Double Poly

Replace or repair.
It will only cost you dearly on your energy costs
if you don't.

External Conditions Effect
The Assembly R Values.

Simple things such as wind can have dramatic effects on the thermal properties of walls and roofs. This chart on this page reflects the effects of various wind speeds and the relation that results in the assembly R and U valves. This chart is for a horizontal application ie roof. For those interested for a wall (vertical application), the inside air film layer should be replaced with 0.68. You will not at the bottom of the chart is a summary which indicates how much extra heating is required due to the increased air speed outdoor. It actually is quite significant isn't it.

The real reason we included this chart is really to help one understand the need for a good level of safety factor in your heating design selections. Out here in Western Canada we have to operate through adverse conditions which sometimes like to stay around for several days or weeks. Folks just be safe. We see simply too many heating systems (boilers / heaters) sized elsewhere (out of provice/country) and when you run the numbers, they clearly have used a U value of 0.50 for the poly. ie: the low 7.5 mph wind speed and no safety allowance for the poly state as it ages. ..... See the following charts. ....

The effects of wind speeds on the assembly R value.

7.5 mph wind												
	=	**Outdoor air film**	+	**Outer layer of poly**	+	**Dead Air Space**	+	**Inner Layer of Poly**	+	**Inside air film**	=	**R value of assembly**	**U value of assembly**
		0.25	+	0.03	+	1.07	+	0.03	+	0.61	=	1.99	0.50
15 mph wind													
	=	**Outdoor air film**	+	**Outer layer of poly**	+	**Dead Air Space**	+	**Inner Layer of Poly**	+	**Inside air film**	=	**R value of assembly**	**U value of assembly**
		0.17	+	0.03	+	1.07	+	0.03	+	0.61	=	1.91	0.52
30 mph wind													
	=	**Outdoor air film**	+	**Outer layer of poly**	+	**Dead Air Space**	+	**Inner Layer of Poly**	+	**Inside air film**	=	**R value of assembly**	**U value of assembly**
		0.09	+	0.03	+	1.07	+	0.03	+	0.61	=	1.83	0.55

Notice how wind velocity effects the thermal resistance values. As wind velocity goes up, so does the heat loss.
Think wind chill folks. It does exist and if not allowed for you can run into problems if you low ball your heating design.
How many spring and or winter storms do we go through with 30 or 40 mph wind gusts ??? Makes one think.

To better put this in perspective let's consider a 10,000 foot roof.

Outdoor Air	Indoor Temp	U value	Area	BTU/hour heat loss	
-20	70	0.50	10000	452,261	7.5 mile per hour wind outside
-20	70	0.52	10000	471,204	15 mile per hour wind outside
-20	70	0.55	10000	491,803	30 mile per hour wind outside
	A 30 mph wind will impose and extra heating load of			39,542.0	BTU's per hour at -20 deg. F

Sizing Tip **Don't be a fool and allow your heat loss be based on a double poly U valve of 0.5. Folks you'll end up real real short when you need it (weather wise) and when you poly ages a couple years. As a min. use at least 0.55**

Double Poly Thermal Properties are derived from the dead air space between the poly layers.

Add a few holes, tears, loose lock and the dead air space is no longer dead. It is moving and you basically derate the valve of the Dead Air Space component drastically effects the heat loss. The poly that we list in rough shape --- generally based on the last say 22 years of actual field observations would be what growers would consider acceptable. In this case the extra 87,800 BTU heating load is simply ignored and put up with. Hmm maybe a bit of time up in the gutters table and page before. It is simply foolish to undersize or marginally size your heating equipment.

The effects of wind speeds on the assembly R value.

Poly in Good Shape - Great "Dead Air Features"

=	Outdoor air film	+	Outer layer of poly	+	Dead Air Space	+	Inner Layer of Poly	+	Inside air film	=	R value of assembly	U value of assembly
	0.17	+	0.03	+	1.07	+	0.03	+	0.61	=	1.91	0.52

Poly in Relatively Decent Shape - maintains some pressure at 15 minute test

=	Outdoor air film	+	Outer layer of poly	+	Dead Air Space	+	Inner Layer of Poly	+	Inside air film	=	R value of assembly	U value of assembly
	0.17	+	0.03	+	0.92	+	0.03	+	0.61	=	1.76	0.57

Poly In Rough Shape - flaps in wind - has trouble maintaining pressure

=	Outdoor air film	+	Outer layer of poly	+	Dead Air Space	+	Inner Layer of Poly	+	Inside air film	=	R value of assembly	U value of assembly
	0.17	+	0.03	+	0.77	+	0.03	+	0.61	=	1.61	0.62

Notice how the R value of the Dead Air Space drops when poly full of holes. THE AIR SPACE ISN"T DEAD any more.

To better put this in perspective let's consider a 10,000 sq. foot roof.

Outdoor Air	Indoor Temp	U value	Area	BTU/hour heat loss	
-20	70	0.52	10000	471,204	Good Poly
-20	70	0.57	10000	511,364	Reasonable Poly
-20	70	0.62	10000	559,006	Poor Poly - Help those utility bills suck !!!!!!
		Extra Heating Load of the Poor Poly	=	87,802	BTU's per hour at -20 deg. F

See what we mean. Now if we added wind velocity into the equation man it would be rough !
As you can see a U value of 0.55 isn't that crazy .... is it !!!!!!

thermal resistance valves of that component. The chart on this sheet indicates poly in good shape (ie: new and very few holes, tears etc.)

Study this chart over a cup of coffee, take a look how small changes in the R patching tears and holes and readjusting the lock was just deemed to much work.

The second item of value of this chart is further reinforce the value of having some safety in your heating equipment sizing and selection. This gets back to the

Do Your Own Evaluations

The chart below is based on the useful equation tool provided on page one of this issue.

The equation is again listed in the chart.

Table 65

The equation **R1/R2=(Ti-Tx)/Ti-To)** **is a useful tool that can be easily used for self determination of the state of your poly.**

This chart is available in 50 deg. F, 55 deg. F, 60 deg. F, and 70 deg. F conditions. Contact our office if needed.

To conduct your own evaluation of your poly state all that is required is an accurate thermometer for measuring the inside air and the outside air temperatures and a contact thermometer to measure the inside surface temperature of the poly.

To calculate the thermal R value of the poly, solve for R2.

The following chart is based on 65 deg. F indoor temperatures.
R1 based on horizontal surface 0.61

Outdoor Temp. (To) Deg. F	Inside Surface Temp (TX) deg F. (Measured)	Indoor Temp. (Ti) Deg F.	R1 Inside Air Film	R value (R2) of Poly (Calculated)	U value of Poly Assembly	Heat Loss (BTU/hr/sq. ft.)	Poly State
0	44.2	65.00	0.61	1.91	0.52	34.0	Good
0	42.2	65.00	0.61	1.74	0.57	37.3	Acceptable
0	40.2	65.00	0.61	1.60	0.62	40.6	Questionable
-5	42.6	65.00	0.61	1.91	0.52	36.6	Good
-5	40.6	65.00	0.61	1.75	0.57	39.9	Acceptable
-5	38.6	65.00	0.61	1.62	0.62	43.2	Questionable
-10	41.0	65.00	0.61	1.91	0.52	39.3	Good
-10	39.0	65.00	0.61	1.76	0.57	42.5	Acceptable
-10	37.0	65.00	0.61	1.64	0.61	45.8	Questionable
-15	39.5	65.00	0.61	1.91	0.52	41.9	Good
-15	37.5	65.00	0.61	1.77	0.56	45.2	Acceptable
-15	35.5	65.00	0.61	1.65	0.61	48.4	Questionable
-20	37.9	65.00	0.61	1.91	0.52	44.5	Good
-20	35.9	65.00	0.61	1.78	0.56	47.8	Acceptable
-20	33.9	65.00	0.61	1.66	0.60	51.1	Questionable
-25	36.3	65.00	0.61	1.91	0.52	47.1	Good
-25	34.3	65.00	0.61	1.79	0.56	50.4	Acceptable
-25	32.3	65.00	0.61	1.68	0.60	53.7	Questionable
-30	34.7	65.00	0.61	1.91	0.52	49.7	Good
-30	32.7	65.00	0.61	1.79	0.56	53.0	Acceptable
-30	30.7	65.00	0.61	1.69	0.59	56.3	Questionable

So ... you wish to conduct an evaluation for yourself before spending the time up on the gutters patching those pesky tears and rips. Simply take a good and accurate thermometer. Measure and record both the inside temperature and the outside temperatures. Then use a contact thermometer, measure and record the inside surface temperature of the poly.

Now pour a cup of coffee. Time to do some simple math. By using the equation provided solve for R2. This will provide the actual resistance valve of your poly roof or wall.

The above chart shows a few conditions at various outdoor temperatures, a constant indoor temperature of 65 deg. F and the various inside surface temperatures. From these values, the actual R and U valves are calculated. The heat loss per sq. ft. is also provided which reflect the increased heat loss due to poor poly state.

Our term questionable is just that. Basically it means Visual inspection and review. Correction as best as possible. Then retest. If values don't improve, at least you have the information on hand to review just how much leaving that ratty or old poly will cost you in energy or simply just to replace.

As a foot note. For those wishing to be extremely precise in their review, the value of R1 when reviewing a wall should be 0.66. This has been previously discussed in earlier issues.

Also ... please remember .... the size of the poly bubble (inflation effect) will effect the whole assembly. We based these charts on an average bubble of 5". 0" at the gutter, 10" at the peak. A grossly large bubble will greatly reduce the R valve.