High Temperature Applications

Installation & Operation Instructions

Installation and operation of a belt running at high temperature is very similar to installing a belt for room temperature applications. However, there are a few significant differences to be noted.

The furnace/oven must be at room temperature when the belt is installed.

Breaking in the Belt

A high temperature belt must be 'broken in' in a similar method to any high precision equipment. The furnace/oven should be brought up to operating temperature no quicker than 482°C per hour. After reaching operating temperature, the belt should be operated for a period of approximately five hours with no load to assure proper seating of the spirals. Temperature changes invariably produce changes in the tracking properties of the belt. Therefore, during this period close attention must be given to the belt and tracking adjustments made when required.

During the break-in period, the belt should also be stress relieved in order to assure maximum service life. Stress relieving at the correct temperature prevents excessive grain growth, hence increasing service life.

Rapid grain growth with its resulting embrittlement can be prevented in conventional high temperature alloys such as 314 stainless steel, Cambriloy 35-19 Cb, Inconel 600 and Cambriloy 80-20 Cb by making certain that every portion of a belt is held at 927°C for at least one hour before increasing operating temperatures further. For belts operating at less than 927°C a slightly different procedure applies.

Stress relieving procedures may be summarised by the following two suggestions:

1. For alloys operating at 927°C or above, the stress relieving treatment should be given for a sufficiently long period of time that every part of the belt operates at 927°C for at least one hour.
2. For alloys operating at 899°C or below, stress relieving treatment should be given at 50° above the normal operating temperature for a sufficiently long period of time, that every portion of the belt reaches the stress relieving temperature for a period of at least one hour.

After the stress relieving treatment is given, the furnace/oven temperature may continue to be increased at the rate of approximately 150°C per hour until the full operating temperature is obtained. After attaining full operating temperature, the belt should be operated at this temperature for a minimum of five hours before the load is placed on the belt.

It is important that the break-in and stress relieving treatment be given to the belt on the furnace/oven on which it will be operating. During the break-in period, the spirals seated on the rods adjust to the configuration of the furnace/oven on which they are operating. No two furnaces/ovens are identical. Break-in on one furnace and operation on another furnace only induces additional strain within the belt.

In addition, it is suggested that the belt *not* be pre-stretched. High temperature belts in general, possess a measurable and predetermined amount of stretch before failure occurs. Intentional stretching of the belt may save a few hours in maintenance time but will measurably decrease belt life.

Pre-oxidising the Belt

Pre-oxidising the belt can extend the service life. This is particularly true where a containment such as copper penetrates the surface of the belt. The oxide created by pre-oxidising presents a surface more impervious to copper penetration than the unoxidised base metal.

The pre-oxidising treatment is normally accomplished by submitting the belt to an oxidising atmosphere at the regular operating temperature for several cycles through the furnace/oven. In most cases, a trial is suggested before making this a standard practice.

Loading the Belt

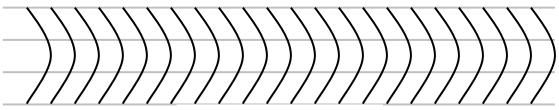
Loading the belt should be accomplished in as uniform a manner as possible. An evenly loaded belt distributes the wear evenly across the bottom surface of the belt ad helps prevent camber and other distortions which may shorten the belt’s surface life.

Temperature and Distribution

Furnaces/ovens are, of course, designed for even distribution of temperature across the belt. However, malfunctions in the heat system, uneven product and load distribution or other unusual conditions could cause uneven temperature across the belt. The resulting different rates of expansion and contraction can have damaging effects on the belt.

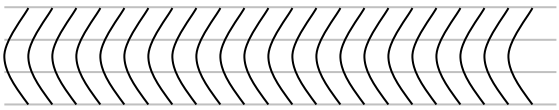
Belt Camber and Wear

Belts operating at high temperature frequently show excessive wear on the bottom surface or develop camber as shown below.



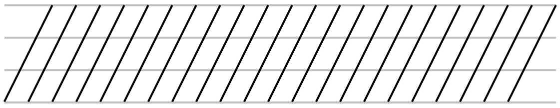
Convex Camber

Direction of Belt Travel →



Concave Camber

Camber in a high temperature belt may be either convex or concave as shown above, or in some cases the camber may develop with one edge of the belt leading the other edge.



Leading Edge

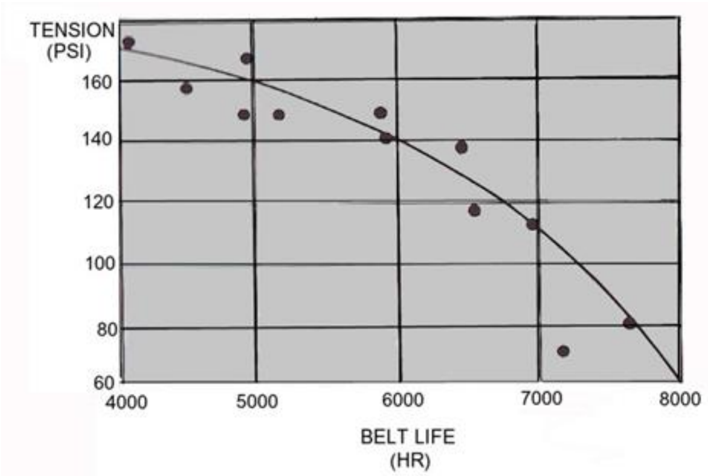
It is frequently caused by factors such as uneven loading, uneven temperature, drafts in the cooling chamber, uneven driving tension or a combination of these factors.

As the amount of the chamber increases, free hinging of the spirals is prevented and they begin to fatigue. Cambering may be minimised by removing the belt from the furnace/oven at intervals, turning it around and running it in a direction opposite that in which the camber was produced. When this done, the individual rods begin straightening and may eventually begin to assume an opposite camber. When this occurs the belt should again be reversed.

Where there is excessive wear on the bottom surface of the belt, the belt may be reversed side for side as well as end for end. Such reversal should be made only while the belt is sufficiently flexible to assure that reversal does not create a fatigue problem.

Effect of Tension on Service Life

As might be expected, the effect of tension upon the service life of belts at high temperature is very pronounced. To determine the exact effect, a study was made of service life versus tension for a variety of installations. The results of this are shown graphically below.



This study was primarily concerned with copper brazing belts operating at 1121°C. But the results are generally applicable to all types of high temperature belts. Every effort should be made to maintain operating tension at the lowest possible value.

Effect of Belt Speed on Service Life

A similar study was made of the effect of belt speed on service life. Again, the figures were obtained from belts operating in copper brazing furnaces/ovens at 1121°C, but the results are also applicable to high temperature belts in general. It was found that increasing the belts speed more than proportionately increases the total number of operating cycles (belt service life).

Idling the Belt

Certain precautions must be observed in Idling the belt if maximum service life is to be obtained. Most idling precautions are self-evident and practiced as a matter of course. However, there are some areas where close attention will provide increased service life:

1. The belt should be idled with atmosphere on.
2. High temperature furnaces/ovens having a counter weight type take up or air cylinder type take up in the discharge end should have the counter tension decreased. Otherwise, counter-tension is transmitted through the belt in such a way that the hot zone tension may actually be higher than was the case with load being carried on the belt.
3. High temperature belts fabricated from Cambriloy 80-20 Cb should not be idled in the preferential oxidation or ‘green rot’ range of 899°C to 1010°C.
4. A high temperature belt must be kept in motion. If allowed to stop, it will tend to weld the hearth and result in serious damage when the belt is restarted.
5. Regular checks must be made of the belt tracking during the idling period as temperature changes frequently induce tracking changes.