SECTION 11005 - MACHINE ALIGNMENT

City of San Diego, CWP Guidelines

PART 1--GENERAL

1.1 WORK OF THIS SECTION

A, This Section specifies requirements for alignment of mechanical and HVAC equipment weighing 1000 pounds or more furnished or modified under this contract. Equipment with drivers 5 horsepower and less are specifically exempted from the requirements of this Section. This Section also includes requirements for alignment software and equipment to be furnished to the OWNER on commissioning of the project.

1.2 QUALITY ASSURANCE:

A. **General:** All equipment shall be aligned using laser alignment equipment to the tolerances specified by the subject equipment manufacturer or the criteria specified in this Section, whichever is more stringent.

B. **Alignment Criteria:** Unless otherwise specified by more stringent manufacturers' requirements, all mechanical equipment affected by this specification shall be aligned to the following criteria:

Speed, rpm, maximum	**Couplings**		**Spacer Shafts offset, mils/ inch of shaft length**
	Offset (mils)	**Angularity (mils/inch)**	
600 and less	5.0	1.0	1.8
900	6.0	0.7	1.2
1200	2.5	0.5	0.9
1800	2.0	0.3	0.6
3600	1.0	0.2	0.3
7200	0.5	0.1	0.15

Notes: (1) Soft foot shall be not more than 2.0 mils for any speed. (2) Separately mounted equipment connected by offset universal joints are exempted from the offset and angularity requirements, but all units must be installed and leveled as specified in this Section.

C. **Alignment Equipment**

1. Alignment equipment used to perform the work required under this Section shall employ laser alignment techniques to achieve the required tolerances. The equipment shall be computer based and shall be compatible with Windows® 95 based spreadsheets and databases. The equipment shall employ a hand-held field computer using a graphic interface to determine actual alignment and necessary corrective action to bring equipment into required tolerance. The computer shall be powered by rechargeable NiCad batteries and shall be capable of storing up to 1000 machine measurement sets, complete with labels, graphics and comments. The link between field measurement instruments and the computer shall be through infrared transmission. Cable link-dependent equipment will not be acceptable. External interface between the field computer and other processors shall be by RS-232C serial cable ports.

2. The laser emitter shall be Class 2 type, FDA 21 CFR 1000 and 1040 compliant, powered by lithium ion batteries. The laser shall operate on a 670 nm wavelength and shall have a beam, divergence of less than 0.3 microradians at a power of not more than 1 microwatt. The laser receiver shall have 5 axis capability with a resolution of 0.04 mil offset and 10 micro radians angularity.

1.3 SPECIFICATIONS AND STANDARDS

A. This Section contains references to the following documents. They are a part of this Section and any referencing section as specified and modified. In the event of conflict between the requirements of this Section or any referencing section and those of the listed documents, the requirements of this Section or the referencing section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
Shaft Alignment Handbook	Shaft Alignment Handbook, second edition, John Piotrowski, Marcel Decker Inc.

PART 2--PRODUCTS

2.1 EQUIPMENT

A. Laser alignment equipment shall be Rotalign® Pro as manufactured by Ludeca, Inc., of Miami, Florida, or equal.

2.2 PRODUCTS TO BE FURNISHED TO OWNER:

A. The following shall be furnished to the OWNER upon completion of all alignment work for the project or appropriate portion thereof and prior to substantial completion of the project or portion thereof:

1. One complete Rotalign® Pro equipment setup, including aluminum carrying case, transmitter, receiver, equipment mounting clamps, cable, spare batteries, hand-held computer and Rotalign® Pro Commander PC ALI 3.592SET computer software for use in records computer, or the equivalent complete setup as accepted for the project.

2. All alignment records, in both hard copy and in computer memory. The hard copy shall be signed and dated by the technician performing the alignment work and shall be witnessed by the CONSTRUCTION MANAGER.

PART 3–EXECUTION

3.1 CONSTRUCTION

A. After machine base grouting as specified under Section 11002, all machines mounted on baseplates or sole plates specified above shall be aligned as specified under this Section. Machines supported on integral feet or support pads shall be leveled, grouted and aligned in the following order: driven machine; intermediate bearings or machines; and driver. All machines shall be aligned without any connections to piping, electrical and instrumentation systems. Upon completion of all field connections, alignment shall be rechecked to demonstrate no change. If change has occurred, the CONTRACTOR shall eliminate any external forces affecting machine alignment and repeat the alignment process. All machine alignment parameters shall be rechecked after the equipment has been brought to operating temperature by operation at specified conditions. Where required by other sections in these Contract Documents, factory authorized installation technicians representing the equipment manufacturer shall witness final alignment work. All alignment work shall be independently checked using the shaft and coupling spool method described in Shaft Alignment Handbook. After completion of all alignment work and acceptance in writing by factory installation technicians, all machines shall be doweled in place using tapered stainless steel dowels. **Alignment work shall be performed by journeyman millwrights skilled in this type of work under the supervision of a technician trained in the use of the laser alignment by the manufacturer of the alignment equipment. The use of laborers, carpenters or apprentices for this work shall not be acceptable.** All final results of the alignment work shall be subject to inspection and verification by the CONSTRUCTION MANAGER.

END OF SECTION