VIBRATION TESTING EQUIPMENT

CUBE-0002
(Revised October 2000)

CUBE Facility Preparation

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Team Corporation

ABSTRACT

The purpose of this guide is to assist you in planning and preparing your facility for installation of the CUBE™. Use of this guide will assure a trouble free installation and optimum performance from your new test system.

This guide will provide requirements for:

- Reaction mass and mounting surface
- Hydraulic power supply and distribution
- Electrical power for control electronics
- Other recommended facilities

REACTION MASS

DESIGN GUIDELINES

A reaction mass is required for all CUBE™ installations. The design and construction of the reaction mass is crucial to the performance of the test system and protection of the surrounding environment. Reaction masses that are improperly designed or lack adequate suspension will allow the energy produced by the CUBE™ to be transmitted to the surrounding facility. The results are degradation of control of the CUBE™ and disturbance of nearby equipment and personnel due to transmitted vibrations.

Team can manufacture reaction masses that are suitable in some cases. These are air isolated and intended for testing at frequencies above 5 Hz. If you intend to test at lower frequencies, we recommend a poured concrete (permanently installed) reaction mass of substantial size.

Team Corporation does not design poured concrete reaction masses but can provide recommended design guidelines as well as information regarding the mass of the test system and the expected forces and moments to the contractor of the customer's choice. Team Corporation's Application Engineers are also available to review proposed reaction mass designs and make general recommendations based on experience.

SIZE, WEIGHT AND CONFIGURATION OF THE REACTION MASS

Many factors affect the size, weight and configuration of the reaction mass. Among these are the building and its construction, soil conditions under the CUBE™, and location of offices and other sensitive equipment relative to the CUBE™.

A typical mass for a CUBE™ system would be:

M_2 = 45,000 - 60,000 lbs.

Because the CUBE™ is a multi-axial test system capable of producing both linear forces and rotational moments, the inertial properties of the reaction mass are very important.

To determine the proper mass moment of inertia for the reaction mass,

$I_{xx} = I_{yy} > 100 \times I_1$

where:

I_{xx}, I_{yy} are the mass moments of inertia about the horizontal axes of the reaction mass

I_1 = the mass moment of inertia of the CUBE™ and test specimen about their combined CG

As before, estimate on the side that will yield more inertia. More is better!

A typical value is:

$I_{xx} = I_{yy} = 120 \times 10^3$ lbf-in-sec^2

The reaction mass designer should also check the angular displacement of the reaction mass under all anticipated operating conditions. Due to the size of the reaction mass, the displacement of the edge can become significant due to rotational motions.

As an example, a reaction mass constructed of steel and satisfying the mass and inertial properties listed above would be 84 inches square and 30 inches thick. An equivalent concrete reaction mass would be 96 inches square and 60 inches thick.

There may be occasions when these guidelines must be violated because of other constraints. If in doubt, make it heavier.

REACTION MASS ISOLATION

The reaction mass **must** be isolated from the facility. Vibration transmitted to the ground can be aggravating to personnel and potentially destructive to nearby structures, tooling and test equipment.

In general, it is recommended that the mass be supported on soft springs. Air springs are used frequently and are available in a wide range of configurations from a variety of manufacturers. Team Corporation offers a Low Frequency Air Isolator Assembly suitable for mounting to a steel reaction mass. Contact Team for pricing and details.

If the mass is placed directly on the earth without isolation, a resonance of the soil will result in vibration being transmitted into the facility. The soil resonant frequency varies with the soil conditions, but is usually in the 15 to 20 Hz region.

Even the most effective isolation system is not perfect. All designs will allow some vibration to be transmitted. It is up to the reaction mass designer to determine what level of transmission will be acceptable in a particular application.

It is not advisable to operate the test system at or near the isolation system resonant frequency. Therefore it is desirable to design an isolation system with a natural frequency as low as possible. As a rule of thumb, the isolation system should be designed with a natural frequency of 1/3 to 1/2 the lowest desired operating frequency of the test system. However, getting the natural frequency low is often expensive. Again, the designer must balance the functional and economic constraints for each application.

Customers wishing to design their own reaction mass and isolation system are advised to contact the following for more information on isolation techniques:

Barry Controls, 617-787-1555

Firestone, 800-888-0650

Goodyear, 800-541-7821

CONSTRUCTION METHODS

Steel and concrete are the two most common materials of choice for reaction mass construction. Relatively inexpensive and readily available, they offer high density and ease of construction.

Solid Steel

Stacked solid steel plates can be used for small to medium reaction masses. Steel masses constructed in this way are also somewhat portable as they can be disassembled and reinstalled at another location.

Six-inch thick plates are generally available and are recommended. Between each plate a layer of EAR damping material is required. The whole stack of plates must be held together, keeping the damping material in compression. This material is available from Team or the manufacturer:

E-A-R Specialty Composites
7911 Zionsville Rd.
Indianapolis, IN 46268
USA
Phone: (317)692-1111
Fax: (317) 692-3111

The bottom plate should be tapped to accept studs, which will hold the assembly in compression. Each additional plate is drilled with clearance holes for the studs. With the top plate in place, nuts and washers allow the assembly to be placed in compression.

Reinforced Concrete and Steel

For more detailed information on the construction of a concrete reaction mass for the CUBE, please refer to CUBE Reaction Block Guidelines.

For large masses reinforced concrete is the material of choice. As with steel, a sandwich construction technique is recommended. Steel plates top and bottom, joined by through studs that are free to move along their axis allow the concrete in between to be placed in compression. Additional structure is provided by liberal use of re-bar inside the concrete mass.

MOUNTING SURFACE

The CUBE must be installed on a steel plate attached to the top surface of the reaction mass. The plate must be free of high spots and flat to within 0.005 inches per foot.

The CUBE module is attached to the reaction mass by socket head cap screws installed in threaded holes in the top surface of the reaction mass. Team will provide a drawing illustrating the mounting hole pattern and thread specifications.

Between the CUBE and the reaction mass a layer of EAR visco-elastic material is required. This material is available from Team or the manufacturer:

E-A-R Specialty Composites
7911 Zionsville Rd.
Indianapolis, IN 46268
USA
Phone: (317) 692-1111
Fax: (317) 692-3111

HYDRAULIC POWER

OIL TYPE

Team Corporation uses and recommends Mobil DTE-26 hydraulic oil. This oil is readily available and has desirable viscosity characteristics. Please consult Team Corporation if you intend to use any other type of hydraulic oil in your system.

PRESSURE

All CUBE™ models are designed to operate with a 3,000 psi hydraulic supply. A backpressure relief valve is required on the return line and should be set to 150 psi. If a backpressure relief valve is not available one can be installed on the Team Hydraulic Conditioning Manifold. You must inform Team of this need.

FLOW

Flow rates vary with the application and may be anywhere from 35 to 200 gallons per minute (gpm) depending on the model and the tests being run.

TEMPERATURE

The recommended operating temperature of the hydraulic oil is 100-110 degrees F. Water cooled hydraulic power supplies used in conjunction with closed circuit cooling towers are most common in these applications.

TEAM CORPORATION HYDRAULIC POWER SUPPLIES

If Team built your hydraulic supply, the following table lists its rated flow. Also listed are the electrical horsepower and cooling water requirements.

HPS Model	Flow	Horsepower	Cooling Water @ 80°F
HPS-25	7 gpm	15 hp	4 gpm
HPS-65	15 gpm	40 hp	8 gpm
HPS-110	30 gpm	60 hp	16 gpm
HPS-190	50 gpm	100 hp	25 gpm
HPS-265	70 gpm	150 hp	35 gpm
HPS-380	100 gpm	200 hp	50 gpm
HPS-460	120 gpm	250 hp	60 gpm
HPS-535	140 gpm	300 hp	70 gpm
HPS-650	170 gpm	340 hp	80 gpm
HPS-800	210 gpm	420 hp	100 gpm

Table 1 – Team HPS Specifications

OIL QUALITY

Clean oil is critical to the performance and reliability of the CUBE™. Nothing will do more damage faster than contaminated hydraulic oil. Team Corporation's warranty requires the use of the proper grade of hydraulic oil and maintaining it in ISO 15/13/10 or better condition. It should be at least 16/14/11 before the CUBE™ is started up.

If Team provided your hydraulic power supply it is already properly equipped for use with the CUBE™. If Team did not supply your hydraulic power supply, please check with the vendor and verify that it is properly equipped to maintain the oil quality specified. The supply line must have a 3-micron or finer filter, and the return must have a 25-micron or finer filter. Team also recommends the use of a "kidney loop" with 3 micron or better filtration to continuously filter the hydraulic oil and maintain its cleanliness.

Team recommends that the oil be sampled as often as weekly when the CUBE is run continuously. The resulting oil condition history can be very useful in identifying potential problems before something fails.

IMPORTANT NOTE: Team Corporation will require an oil analysis verifying the condition of the hydraulic oil prior to installation and startup of the system. You will need to take an oil sample and send it to a reputable lab for analysis. The analysis must show that the ISO cleanliness is better than 16-14-11.

TRANSMISSION LINES

Hydraulic transmission lines, in the form of flexible hoses or steel pipe, must be provided between the hydraulic power supply and Hydraulic Conditioning Manifold (HCM). Team Corporation will provide flexible hoses to connect the HCM to the CUBE™ module.

Two high-pressure lines and one low-pressure line are required. The high-pressure lines are the pressure and return lines and must be rated for a working pressure of at least 3500 psi. (Higher if the power supply is capable of delivering higher pressures). The low-pressure line is a drain or suction line and must terminate at the hydraulic power supply reservoir. The low-pressure line must be rated for a minimum working pressure of 300 psi.

The location of the hydraulic power supply will often dictate the choice of transmission line material and size. Short distances can be accommodated with flexible hydraulic hoses. Longer distances call for hard lines made of welded steel or stainless steel pipe. In either case, pressure drop in the transmission lines should be kept to a minimum and flow velocity should not exceed 15 ft/sec.

The pressure and return fittings on the HCM are male, -20 (1¼inch), 37 degree JIC. The drain/suction fitting is a male, -16 (1 inch), 37 degree JIC.

ELECTRICAL POWER

GENERAL

All electrical work must be done by a qualified electrician and be in compliance with all relevant codes and regulations. Team Corporation's field service technicians are not qualified electricians and are not authorized to install or modify your electrical service.

HYDRAULIC POWER SUPPLY

If ***Team*** Corporation supplied the hydraulic power supply with the system, please refer to Team Corporation Hydraulic Power Supplies on page 3 for the electric motor horsepower required.

HYDRAULIC CONDITIONING MANIFOLD

The HCM requires a 120 VAC, 60 Hz, single phase, 40-ampere service.

CONTROL ELECTRONICS

Console power should be filtered from outside RF interference and line-regulated to provide 105-130 VAC, 50-60 Hz, single phase, 20 ampere service. An isolated power supply is recommended to reduce potential damage to components or equipment from power loss.

OTHER RECOMMENDED FACILITIES

OVERHEAD CRANE

Team recommends the installation of an overhead crane or other lifting mechanism with a minimum capacity or 1 ton. This is to facilitate installation, use and maintenance of the test system.

COMPRESSED AIR

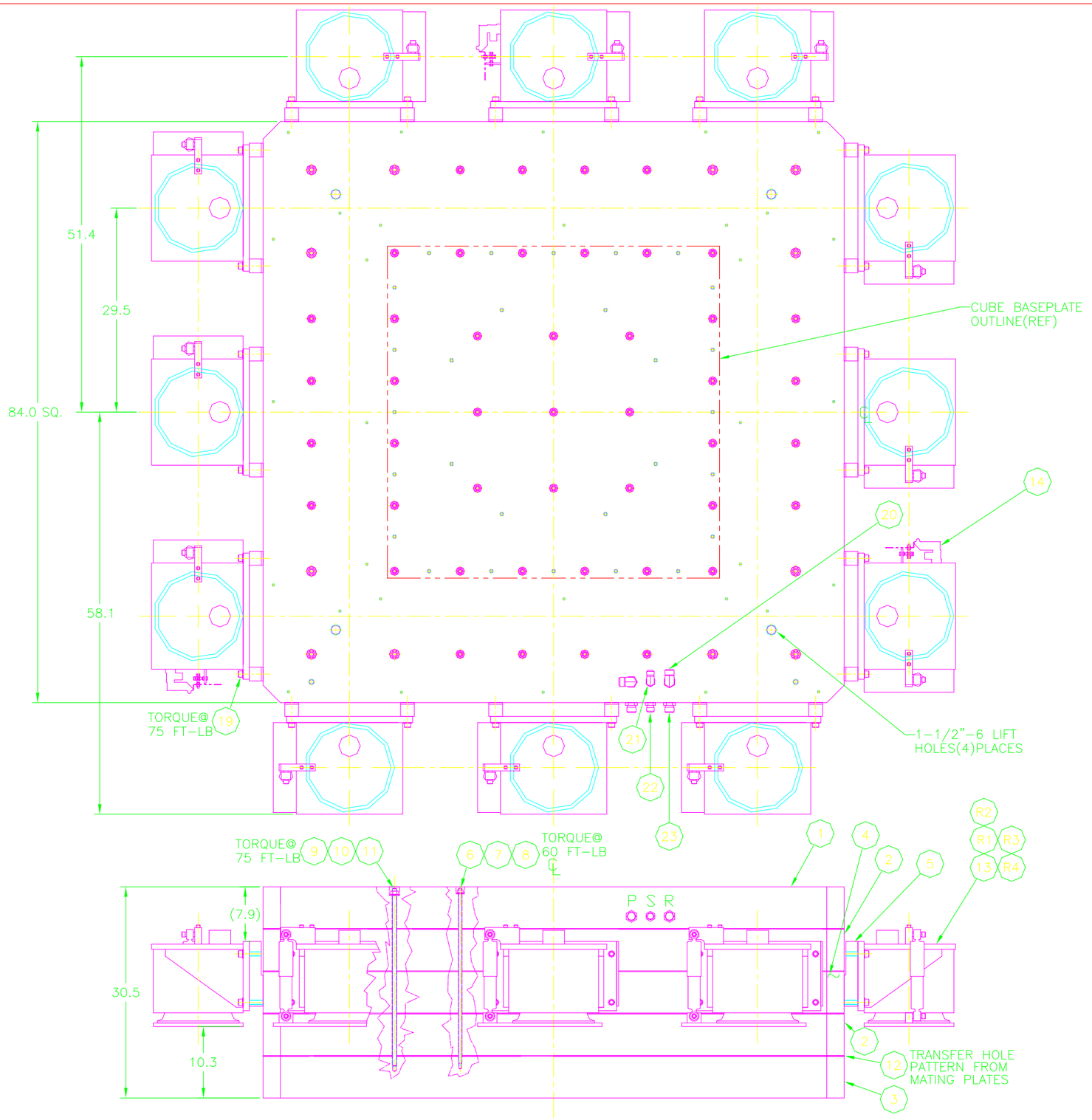
If an air isolated reaction mass is used, a convenient supply of compressed air is required. The air pressure should be regulated and filtered to prevent damage to the air isolators.

CONTACT

If you have any questions regarding the information in this guide, or you would like assistance in planning your facility, please contact Team Corporation via the following methods:

Team Corporation
11591 Watertank Road
Burlington, Washington 98233
U.S.A.

Telephone: +1 (360) 757-8601
Facsimile: +1 (360) 757-4401
E-mail: sales@teamcorporation.com
WWW: http://www.teamcorporation.com



REVISIONS				
REV	DESCRIPTION	DATE	BY	APPROVED
D	CHANGED BORDER & PARTS LIST	3/26/99	CBS	

ITEM	DRAWING	REFERANCE DRAWING
R1	C10396	SUB-ASS'Y AIR BAG SHOCK BRACKET
R2	C10397	SHOCK BRACKET DETAIL / WELDMENT
R3	C10306	BRACKETS, SERVO AIR VALVE AIR-ISOLATOR
R4	C05625	HOUSING AIR ISOLATOR W/PROTECTIVE TUBE

ITEM NO.	DESCRIPTION	MANUFACTURER	PART NUMBER	QTY REQD		DRAWING SIZE/NO.
24	WASHER, 5/8 SAE STD ZP ASTM F436	MCM-STD	90126A035	48		
23	CONN., ST. THD.	PARKER	16F50X-S	2		
22	CONN., ST. THD.	PARKER	12F50X-S	1		
21	ELBOW, ST. THD.	PARKER	12C50X-S	1		
20	ELBOW, ST. THD.	PARKER	16C50X-S	2		
19	SHCS 5/8-11 X 2.25, STL BLK OX ASTM A574	MCM-STD	91251A803	48		
18	NOT USED	NA	NA	0		
17	NOT USED	NA	NA	0		
16	NOT USED	NA	NA	0		
15	NOT USED	NA	NA	0		
14	AIR ISOLATOR LEVELING SCHEMATIC		5080301	1	D	12221
13	AIR ISOLATOR ASSY		3216800	12	C	05741
12	EAR	E-A-R	C-1002-12(84"X84")	4		
11	THREADED ROD B7 ASTM A193	MCM-STD	5/8-11X25-5/8"	12		
10	WASHER, 5/8 HI STRENGTH ZP ASTM F436	MCM-STD	98023A035	12		
9	NUT HEX 5/8-11 GRD. 5 ZINC-PLTD. STL	MCM-STD	95462A533	12		
8	THREADED ROD B7 ASTM A193	MCM-STD	1/2-13X25-3/8"	45		
7	WASHER, 1/2 ASTM F436 SAE HI STRENGTH ZP	MCM-STD	98023A034	45		
6	NUT ALLEN 1/2-13	MCM-STD	92066A033	45		
5	SPACER MOUNT		4404101	24	B	11519
4	MOUNT PLATE, REACTION MASS		4404105	1	D	11554
3	BOTTOM PLATE, REACTION MASS		4404104	1	D	11551
2	INTERIOR PLATE, REACTION MASS		4404103	2	D	11550
1	TOP PLATE, REACTION MASS		4404102	1	D	11549

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± 1/32 DECIMALS .X ± .06 .XX ± .02 .XXX ± .005 .XXXX ± .0005 ANGLES ± 1/2°

MATERIAL

FINISH

HEAT TREAT

SCALE 1:8 | EST. WT(lbs) 62.450

DRAWN S. KHTAIAN | DATE 1/12/98

CHECKED | DATE

Team Corporation
IMPROVED PRODUCT QUALITY THROUGH ADVANCED VIBRATION TEST SOLUTIONS
11591 WATER TANK ROAD
BURLINGTON,WA 98233-3607 USA (360)-757-8601

TITLE
REACTION MASS ASSEMBLY, CUBE (VISTEON CCD)

JOB NO.	DWG NO.	PART NO.	ASSY NO.	SHEET	REV
6662	D11469	4404100	D11471	1 of 1	D

6662/11469