

TECHNICAL GUIDELINE

Hydraulic Aspects of Pumping and Gravity Mains



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Major Changes Incorporated In the January 2005 Edition

The following lists the major changes to the January 2005 edition of TG 32, which have been incorporated in this edition:

1. Nil

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Section 1: Scope

Sets out the criteria for the hydraulic design of major pumping mains and gravity pipelines/mains for water supply applications.

Section 2: Pumping and Gravity Mains

This material is under review and development and care must be taken in its application. When using this information please consult with the Manager Engineering Services to verify the appropriateness of its application.

The background for determining hydraulic grade lines, surge, and the pipeline's hydraulic structures and equipment is well documented in the Water Pumping & Distribution Manual.

A check list for field hydraulic surge testing has been included as Appendix A.

Appendix A: Checklist: Hydraulic Surge Testing

Item	Aspects to be Considered
Project Requirements	<ul style="list-style-type: none"> • Scope of the work. • Boundaries and limitations of test program. • Current operating problems with the system. • Contact person for the work. • Agreeing the cost and the timeframe for the work.
Equipment Maintenance (Generally Carried Out on a Regular Basis)	<ul style="list-style-type: none"> • Calibration of <ul style="list-style-type: none"> ○ pressure transducers ○ pressure gauges ○ mechanical recorders • Check the: <ul style="list-style-type: none"> ○ operation of data loggers ○ power connections / safety switch <p>The gauges and transducers are all high quality instruments and need careful handling. They should be transported in their boxes flat on the car floor.</p>
Safety Precautions	<ul style="list-style-type: none"> • All staff must wear appropriate safety clothing • All care must be taken near moving machinery • The danger of high pressures in pipelines must not be underestimated • Record Contact Persons/phone numbers etc.
Investigation	<ul style="list-style-type: none"> • Inspect site with operators if required. • Determine Design Pressure Level (DPL). • Determine in Consultation with Operators the: <ul style="list-style-type: none"> ○ possibility of air in the system ○ pipe material and its condition ○ current operating conditions and issues ○ availability of fittings for connecting test equipment
Planning of Test Procedure	<ul style="list-style-type: none"> • Determine/organise the test program taking into consideration: <ul style="list-style-type: none"> ○ flow ranges ○ number of pump stops eg 1,2 or 3 etc ○ reflux closure time /slam ○ surge protection operation monitoring ○ locations of pressure monitoring ○ availability of power supplies ○ selection of instruments in accordance with availability of power, pressure rating and if charts are required.
Operation of Plant/ During Testing	<ul style="list-style-type: none"> • Make clear to all personnel assisting with the test that all starting /stopping of the plant can only be carried out by the Plant Operator appointed for the Test Program. • The Test co-ordinator is the only person who can determine in conjunction with the Plant Operator the course of action in operating the plant during the Test Program. • Test are carried out starting with the lowest pressure cases first. • Discuss with Plant Operator the results of the previous test run and make any adjustments to the operation of the system (eg Alteration to levels in the air vessels, time between pump start/stop) before the

Item	Aspects to be Considered
	next run takes place at the higher pressure level.
Test Point Location and Procedures	<ul style="list-style-type: none"> • Personnel required for full test program eg major pipeline: <ul style="list-style-type: none"> ○ One Test Point Recorder (preferably an operator) at each test location (generally 3 or 4 locations) plus the Test Co-ordinator and the Plant Operator. • Testing points (transducers) are generally located on the: <ul style="list-style-type: none"> ○ suction manifold of the pump ○ downstream of each reflux valve on the delivery side ○ at each test location on the pipeline eg high and low points in the system, air vessels etc • Test gauges are placed at each test site to record the static head, head when the pump is running. • Connection arrangements to the pipework must include a stopcock to isolate the gauges during shut down and start up. • IMPORTANT: Test gauges should not be subjected to surge pressures due to say, pump start or stop. Read the pressures during static conditions and always leave the gauges isolated.
Test Results to be Recorded	<ul style="list-style-type: none"> • Flow for each test. • Static pressure and pressure with pump running at each test site. • Pressures induced on the system by changes to flow conditions (measured by pressure transducers at each test location). • Run down time for pumps to determine the inertia. • Pump reflux valve shut down time • Water levels in air vessels. • Opening and closing time for the air vessel reflux valves.
Analyse results	<ul style="list-style-type: none"> • Collect data from recorders • Determine reference datum for pressures • Examine surge wave characteristics (eg. Pumping system) for the following cases: <ul style="list-style-type: none"> ○ Static head no pumping ○ Static head pumping ○ Maximum pressure / spike - duration ○ Minimum pressure / spike - duration ○ Pressure rise from static head ○ Pressure drop from static head ○ Maximum pressure variation ○ Time taken from pump stop to reflux valve closure ○ Reflux valve closure – reaction to flow condition, noise level / slam ○ Time taken for surge pressures to attenuate ○ Pressure cycle times
Prepare Report	<ul style="list-style-type: none"> • Report to be prepared using the following headings: <ul style="list-style-type: none"> ○ Test set up ○ Test procedure ○ Test results ○ Discussion on results ○ Hydraulic system performance ○ Recommendations • Provide comment on operation of all fittings/controls in the system. eg. air valves, reflux valves control valves surge vessels, pumping

Item	Aspects to be Considered
	<p>unit, pressure reducing valves etc.</p> <ul style="list-style-type: none"> • A summary should be included and recommendations made for: <ul style="list-style-type: none"> ○ Repair/maintenance of installations. ○ Control changes needed for devices ○ Future operation of the system