Wastewater Expertise

Technical Guideline

TG 0850 – Wastewater Treatment Plant Aeration Diffuser Site Acceptance Testing

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Application & Interpretation of this Document

It is the responsibility of the users of this Guideline to ensure that the application of information is appropriate and that any designs based on this Guideline are fit for SA Water's purposes and comply with all relevant Australian Standards, Acts and regulations.

Users of this Guideline accept sole responsibility for interpretation and use of the information contained in this Guideline. Users should independently verify the accuracy, fitness for purpose and application of information contained in this Guideline.

Only the current revision of this Guideline should be used which is available for download from the SA Water website.

Significant/Major Changes Incorporated in This Edition

This is the first issue of this Technical Guideline.

Document Controls

Revision History

Revision	Date	Author	Comments
1.0	18/02/2022	Mark Papadimitriou	Original.

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1 Introduction

SA Water is responsible for operation and maintenance of an extensive amount of engineering infrastructure such that it is safe and fit for purpose.

This guideline has been developed to assist in the design, maintenance, construction, and management of this infrastructure.

SA Water completes regular Diffuser replacement programs and there is currently no guidelines on installation or testing. This guideline shall set a standard for all SA Water diffuser works including those with Major Framework Partners.

1.1 Purpose

The purpose of this guideline is to detail minimum requirements to ensure that infrastructure covered by the scope of this document are constructed and maintained to consistent standards and attain the required asset design life. Sufficient diffuser installation and maintenance maximises aeration in the basin for the process benefit of the treatment plant.

1.2 Glossary

The following glossary items are used in this document:

Term	Description
DO	Dissolved Oxygen
FDS	Fixed Distributed System
HS	High Salinity
P&ID	Process & Instrumentation Diagram
SA Water	South Australian Water Corporation
TG	SA Water Technical Guideline
TS	SA Water Technical Guideline
WWTP	Wastewater Treatment Plant

1.3 Definitions

The following definitions are applicable to this document:

Term	Description
SA Water's Representative	The SA Water representative with delegated authority under a Contract or engagement, including (as applicable): • Superintendent's Representative (e.g. AS 4300 & AS 2124 etc.) • SA Water Project Manager • SA Water nominated contact person
Responsible Discipline Lead	The discipline expert responsible for TG 0850 defined on page 3 (via SA Water's Representative)
Constructor	The organisation responsible for constructing and installing infrastructure for SA Water whether it be a third party under contract to SA Water or an in-house entity.

2 Scope

This Technical Guideline aims to provide guidance on the minimum level of testing and inspection required to verify that the installation of aeration diffusers in Wastewater Treatment Plant (WWTP) has been conducted in a manner that is satisfactory to SA Water. A SA Water representative must sign off on the completion of the following:

- The installation of diffusers as part of a new aeration system in either an existing or new treatment plant.
- The installation of new or like-for-like type of diffusers on an existing diffuser grid.
- A major overhaul of an existing diffuser grid including replacement of significant proportion (>25%) of membranes and/or associated pipework and supporting structures.

This document is not intended to supersede instruction from suppliers regarding the installation of their product or how to assess the quality of installation. Rather, the contents of Table 2 should be considered in relation to the scenarios listed in Table 1.

Table 1: Outline of intended use of this document

Scenario	Use
Supplier has provided documentation which includes a detailed methodology for assessing the installation. This should specify the following to equal or greater standard, as agreed by SA Water, than outlined in Table 2: • Methodology for leak testing and leak repair • Number and range of flow rates at which grid is tested • Duration of testing at each flow rate • Levelling tolerances across the diffuser grid	Follow supplier's instruction
Supplier has provided documentation during tendering stage that is accepted by SA Water as part of the procurement process, which provides a methodology that is of an equal or greater standard in some but not all aspects when compared to Table 2.	Follow supplier's instruction where applicable. Follow Table 2 elsewhere
No, or poor, documentation has been provided by supplier. Or documentation is not required to be provided as part of the project.	Follow Table 2

It is the Constructor's responsibility to provide the following as required by the SA Water representative.

1) An A3 printout of the final diffuser layout (1 for each reactor) to mark leaks as located and note repair work undertaken.
2) Copy of relevant P&ID's and construction drawings.
3) Copy of control philosophy and FDS if the project includes new controls or monitoring. If documentation has not been finalised a draft or brief overview of relevant control loops and set points may be sufficient.
4) Copy of commissioning plan provided to SA Water.

Table 2: Nominal diffuser acceptance testing procedure.

Item	Method	Check	Action
Levelling	Fill basin to diffuser level using re-use or potable water.	Diffusers that are outside of specified tolerance (typically ± 3 mm). As it can be difficult to observe from walkways, each diffuser should be checked by relevant personnel inside the reactor.	Relevant personnel to level diffusers.
Leak Testing	1. Fill tank until to approximately 100 mm above the diffusers. 2. Start blowers at idle and run on as low flow as practical. (For reference Bolivar HS was 20 – 25%) 3. After diffusers receiving low flow are checked shut-off individual grids using valves and observe. 4. Depending on the scope of the project it may be necessary to look for leaks in joins above water level. One method of this is to apply a thin film of detergent or similar over joins and check to see if bubbles form.	While air is running look for diffusers which are not working or significantly underperforming.	Have relevant personnel tap and/or massage diffuser to help release any internal check valves. Record any that still appear not be functioning well. Consider repeating/reviewing Leveling
		While air is running look for any coarse bubbling to indicate leaks.	Have relevant personnel investigate and remediate as required. Mark and make note of action on layout.
		When section is isolated look for bubbles streaming from joints, edge of discs or ends of panels.	Have relevant personnel investigate and remediate as required. Mark and make note of action on layout.
Flex of Membranes	Fill tank to 300 mm above diffuser level	Run at minimum design flow for 4 hours, repeat Checks as per Leak Testing.	Actions as per Leak Testing. If grid is fitted with inverted diffusers note at what flow rate purge is being engaged.
		Run at average design flow for 4 hours, repeat Check as per Leak Testing.	
		Run at maximum design flow for 4 hours, repeat Check as per Leak Testing.	
24 Hour Run In	Fill tank to 300 mm above diffuser level	Run at minimum design flow for 24 h (or over weekend) then repeat Check as per Leak Testing.	Actions as per Leak Testing.

Item	Method	Check	Action
Pattern Testing	Ensure tank is filled to 300 mm above diffuser level or 500 mm at tank level	Run at minimum design air flow rate, observe even and uniform aeration pattern, noting any obvious dead spots or coarse bubbling.	If required carry out repairs and re-test.
		Run at average design air flow rate, observe even and uniform aeration pattern (or aeration pattern as intended by design), noting any obvious dead spots or coarse bubbling. Note aeration pattern around DO probe.	
		Run at maximum design air flow rate, observe even and uniform aeration pattern, noting any diffuser malfunction or coarse bubbling. A scattered 5% malfunction is tolerated, but any obvious dead zone should be eliminated. Ensure flow through each diffuser is below maximum air flow permitted for individual diffuser (refer to supplier's data sheet)	
		Reduce air flow to the minimum air flow rate permitted by diffusers, i.e. ***minimum air flow rate per diffuser*** (refer to supplier's data sheet) x Total number of diffusers. Observe aeration pattern and note diffuser units that are not operational.	
		Where inverted coarse bubble diffusers are installed for condensate bleed, run at minimum air flow required to engage all invert diffusers. Note performance variations between invert diffusers. Engage high flow purge operation as required if signs of condensate are obvious and impact pattern testing.	

Item	Method	Check	Action
Operation Outside of Design Envelope (as identified by operators)	If it has been indicated that the plant operates outside of the design range (i.e. periods with blowers at idle such as SBR operation) test and observe with operators while basin still contains clean water.	Run as per operator instruction.	Make note of system performance and any changes observed by operators between new and old system, if applicable.
Process Commissioning	If required conduct process commissioning per the Process Commissioning Plan agreed to by all parties.	Per Process Commissioning Plan	Review any issues with project manager, relevant SAW personnel, operational personnel and designer. Ensure that all agreed actions and expected outcomes are met.
Benchmarking diffuser performance (this is on diffuser performance, i.e. leak, pattern etc not on overall aeration performance)	All relevant parties are to monitor process for the ***agreed process proving period***. This includes monitoring air usage, bubble pattern, spot testing DO throughout the reactor and performance of any relevant instruments and controls.	Confirm the following: • Aeration system is performing within design specification. • Instruments are performing per design • Controls are functions as per design intent.	Review any issues with project manager, relevant SAW personnel, operational personnel and designer. Ensure that all agreed actions and expected outcomes are met