



Neutral Citation Number: [2013] EWHC 4004 (TCC)

Case No: HT-12-422

IN THE HIGH COURT OF JUSTICE
QUEEN'S BENCH DIVISION
TECHNOLOGY AND CONSTRUCTION COURT

Royal Courts of Justice
Strand, London, WC2A 2LL

Date: 13/12/2013

Before :

THE HON MR JUSTICE RAMSEY

Between :

**WEST 3 MECHANICAL CONTRACTORS
LIMITED**

Claimant

- and -

MIZEN DESIGN BUILD LIMITED

Defendant

Roger Bartlett (instructed by **Bonningtons**) for the **Claimant**
Seb Oram (instructed by **GSC Solicitors LLP**) for the **Defendant**

Hearing dates: 11th, 12th and 18th November 2013

Approved Judgment

I direct that pursuant to CPR PD 39A para 6.1 no official shorthand note shall be taken of this Judgment and that copies of this version as handed down may be treated as authentic.

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THE HON MR JUSTICE RAMSEY

Mr Justice Ramsey :

Introduction

1. The Claimant (“West 3”) was a subcontractor to the Defendant (“Mizen”), the design and build contractor for a development known as Ira Court in Tulse Hill in South East London (“the Project”). The Project involved the construction, amongst other things, of 103 flats above commercial premises.
2. The Project consisted of two blocks, Block A and Block B. Block A is a shorter building with five storeys, including a basement. Block B is a longer building with six storeys.
3. Mizen was employed as the contractor by Ujima Housing Association under an agreement entered into on 24 March 2005. The sub-contract agreement between West 3 and Mizen (“the Agreement”) was dated 10 November 2006, although it was ultimately executed on 23 November 2006.
4. Part of the work which West 3 had to carry out involved installing pipes to distribute gas from the gas meter to each of the flats. At a late stage there was a change to the gas distribution system so that, instead of having a gas meter in each flat there was to be a gas meter room in the basement. A separate distribution pipe for each flat would then go up a riser duct and to a valve in each flat.
5. After West 3 left site a problem arose because the distribution pipework installed between the meters in the basement and the flats created an excessive pressure loss so that the pressure of gas at the hob and boiler of each flat was insufficient. I shall refer to this as “the gas pressure defect”.
6. Remedial works were then undertaken, in which both West 3 and Mizen were involved. The basis upon which they were undertaken, whether as remedial work or as additional work, is disputed. Depending on which party is liable for the gas pressure defect there are then financial claims.
7. The court ordered the trial of a preliminary issue as to:

“the responsibility for the inability of the system installed at Ira Court, 214-38 Norwood Road, Tulse Hill, London SE27, to deliver adequate gas pressures to a substantial number of the flats in that development”.
8. In this judgment I deal with that preliminary issue which has, in turn given rise to a number of sub-issues which are then, in turn, divided into further questions. Those sub-issues might be summarised as follows:
 - (1) What was West 3’s contractual obligation under the Agreement as regards the size of the gas pipework?
 - (2) Was the original contractual obligation ever effectively varied and, if so, what was the effect of any such variation?

- (3) Did the system as originally installed fail to deliver sufficient gas pressure to a substantial number of flats and would the system in the revised drawings have delivered adequate gas pressures to all the flats?
- (4) Did the defect which caused the failure to deliver sufficient gas pressure result, wholly or partly, from West 3's breach of the terms of the Agreement?
9. Before dealing with those issues, it is convenient to set out some further background by way of a chronology and a summary of the factual and expert evidence.

Chronology

10. On 24 August 2006 Mizen wrote to West 3 to ask for a quotation to carry out the plumbing and heating subcontract work at the Project. That letter enclosed documents which included Mizen's contract conditions and general conditions of enquiry, scope of works, generic plumbing and heating trade specification and a drawing register dated 24 August 2006 with, amongst other drawings, the Wilkins MacKenzie's drawings 100 to 120 Revision A.
11. Mr Danny Farren submitted West 3's tender on 28 September 2006.
12. On the same day Andrew Mullins of Mizen sent Peter MacKenzie of Wilkins MacKenzie comments received from Ujima on Wilkins MacKenzie's drawings. Those comments raised questions of where the meters might be located. It was stated that the meters were not to be located within flats and were to be located so that they could be read externally. There were then discussions between Mizen and Ujima as to how this could be achieved and in a further email on 28 September 2006 Mizen indicated problems with running 103 separate gas supply pipes from the basement to the individual flats.
13. Mizen held a post-tender meeting with West 3 and on 6 October 2006 Mr Chapman set out notes of that meeting in a letter. At that stage nothing was mentioned about the gas meters. On 10 and 18 October 2006 West 3 sent Mizen revised prices for the work.
14. This led to a pre-order meeting on 20 October 2006. In Mr Chapman's letter of 23 October 2006 he set out notes of that meeting, recorded that the revised quotation was in the sum of £665,308.66 and noted from the meeting at item 11:
- "Gas meters are to be situated in the basement in locations as tabled at the Pre-Order meeting. Extra over costs requested for track pipe sub-mains from the meter positions up the risers and into the flat distribution network."*
15. At the meeting, as Mr Farren said in evidence and Mr Chapman confirmed, he was provided with a marked up plan of the basement level showing the location of the gas meter room and, in addition, the gas pipe routing using the riser duct was indicated to him.

16. On 24 October 2006 Mr Farren wrote to Mr Chapman to say that, further to Mr Chapman's letter, West 3's revised price was now £727,606.00. On 25 October 2006 Mr Farren wrote a further letter in which he said that this price had allowed for the supply of 1½ inch TracPipe gas supply and gave prices for the use of 1¼ inch or 1 inch TracPipe. He added:

“Please could you confirm with the consultants as to what size pipe is suitable for the gas runs.”

17. On 3 November 2006 Mr Farren sent an email to Mr Chapman stating that West 3's price would be £693,000.00. Mr Chapman sent a fax later that day indicating some additional basement drainage to be priced as an “extra over”. He referred to the quotation in the sum of £693,000.00 and asked Mr Farren “to clarify the gas pipe material allowed within this cost.” Mr Farren then responded by email the same day to say “our price has allowed for Tracpipe (up to 1”) which will be clipped to the basement ceiling.”
18. On 10 November 2006 Mr Chapman sent Mr Farren the subcontract order and stated that the order consisted of 18 items. Item 18 was the drawing register dated 24 August 2006 which referred to Wilkins MacKenzie's drawings 100 to 120 Revision A; item 10 was Mizen's letter of 23 October 2006 after the pre-order meeting referring at item 11 to the gas supply pipe and items 6, 7 and 8 were the two emails from Mr Farren and the fax from Mr Chapman all dated 3 November 2006.
19. The Agreement was dated 10 November 2006 although it was signed by Mr Mullins on 21 November 2006 and by Mr Farren on 23 November 2006. The price was £700,345.00, including £7,345.00 for the drainage. It referred to the letter of 10 November 2006 and the drawing register of 24 August 2006. A short description of the Sub-Contract Works was given, as follows:

“Supply of Labour, Materials to include Sanitaryware, and associated Plant to carry out the Plumbing and Heating (Mechanical) Subcontract to the 103 Residential Properties and associated Communal Distribution Network/Pipework at the above Development.”

20. There was then an initial meeting between Mizen and West 3 on 16 November 2006. At that meeting, as noted at items 2.2 and 2.3 of the notes of the meeting:

“2.2 [Mizen] advised that the first area of work would be the installation of the gas pipes, 1st fix to the A block 1st floor flats; screeding is presently programmed to commence on Tuesday, 21st November 2006 and then proceed at the rate of 2 flats per day. [West 3] are to advise if they can commence on Monday, 20th November.

Post Meeting note:

[West 3] have confirmed that they will be commencing on Monday 20th November and will be able to keep in front of the screeders

2.3 [Mizen] are to chase [Wilkins MacKenzie Associates] for issue of revised drawings.”

21. West 3 commenced work on site on 20 November 2006.
22. On 21 November 2006 Mr MacKenzie issued drawings to Mizen. Those drawings included drawings 100 to 120 Revision B and drawings 1000, 1002 and 1010 to 1014 Revision A.
23. On 22 November 2006 Mr Chapman sent Mr Farren a letter in which he said “*please find enclosed latest drawing register and two copies of the associated drawings*”. The attached drawing register shows Wilkins MacKenzie’s drawings 100 to 120 Revision A being issued as a Contract rather than Tender issue. There is an issue whether it was Revision A which was sent or whether the drawing register was incorrect and should, in fact, have said that it was Revision B of those drawings which were being sent.
24. On 5 December 2006 Mr MacKenzie issued further drawings to Mizen. They were drawings 101, 103, 104, 107, 108, 112 and 119 Revision C and 1000 and 1002 Revision B.
25. West 3 made an application for payment on 6 December 2006 on the basis that it had completed work to the value of £800 in 23 flats at the first, second and third floor levels in Block A.
26. On 13 December 2006 Mr Chapman wrote a letter to Mr Farren enclosing the latest drawing register and a copy of the drawings and said that one copy of the drawings had been issued “*direct to your Site Supervisor.*” The drawing register indicated that drawings 100, 102, 105, 106, 109, 110, 111, 113 to 118 and 120 Revision B and 101, 103, 104, 107, 108, 112 and 119 Revision C had been issued. West 3 say that this letter and those drawings were not received either in its office or on site.
27. On 19 February 2007 Mr MacKenzie issued further drawings to Mizen. They were drawings 102 and 106 Revision C, 103, 104, 107 and 108 Revision D and 1000 and 1002 Revision C. A few days later on 24 February 2007 he issued 106 Revision D.
28. On 14 May 2007 Mr Chapman wrote a letter to Mr Farren enclosing the latest drawing register and a copy of drawings. The drawing register indicated that drawing 102 Revision C, 103, 104, 106, 107 and 108 Revision D and 1000 Revision D and 1002 Revision E had been issued. West 3 say that this letter and those drawings were never received.
29. The Project was handed over in about March 2008 and West 3’s final account was agreed on 12 June 2008.

30. In November 2008 Gas Advisory Services produced a gas safety report. They were instructed by Mr Nicholas Spiteri of Calford Seaden LLP acting on behalf of London & Quadrant. Mr Spiteri sent a copy of the report and a list of defects to Mizen on 28 November 2008.
31. On 1 December 2008 Mr Gavin Charlton, Mizen's Operations Director, wrote to West 3 enclosing a copy of the report and stating:

“The drawing and specifications prepared by Wilkins Mackenzie Associates, against which you tendered and on which basis you completed the project, calls for gas distribution network of varying sizes from 28mm diameter upwards and for a network that delivers the gas to consumer outlets with a pressure drop not exceeding 1mbar.

I have become aware that the network is single size (28mm diameter) throughout except for a 1.5/2.0m step down (to 15mm diameter) upside of the boilers.

As you can see from the attached report, inter alia, the dynamic pressure loss is measured down to 14/15 mbar from a figure of 21mbar underside of the gas meters.

I am aware that you adopted in your tender documents, a 25mm diameter distribution system, but from our perspective that had to be without prejudice to the gas pressure criteria written elsewhere in the paperwork—pressure loss ≤ 1.0 mbar throughout.

Please accept this letter as a Formal Notice of Defect and Claim against West 3 Fabrications Limited in the matter and we urgently call for and await your remediation proposals post haste.”

32. At a meeting on 4 December 2008 attended, amongst others by London & Quadrant, Mizen, Gas Advisory Services and Calford Seaden, it was noted that the gas pressure arriving was 21 mbar and the pressure at the flats should have been 20 mbar but a number of flats were registering 10 or 11 mbars. It was noted:

“6.3 A technical solution is needed with regards to increasing the size of the flues where the [TracPipe] runs up. By increasing the size of the [TracPipe], there is space for fewer [TracPipes]. As such, consideration needs to be given as to whether this flue can be enlarged.

6.4 Mizen have advised that there is a strong possibility that this can be done by drilling through the floor slab.”

33. At a further meeting on 15 December 2008 it was noted:

“An update was requested on whether it was possible to enlarge the flues containing the gas [TracPipe]. [Mr Charlton] has said that he has submitted the drawings to the Structural Engineers and is awaiting official confirmation that this is possible, [Mr Charlton] to chase.”

34. In January 2009 Mr Charlton was in contact with Mr Farren. In an email to Mr Farren on 8 January 2009 he noted that the size of the gas pipe and the subsequent pressure drop was the major issue.
35. On 3 December 2009 Mizen wrote to West 3 enclosing a proposed solution to the gas pressure defect which involved relocating the gas meters into the individual flats. This was subsequently done with the involvement of Mizen and West 3.

Evidence

36. I heard evidence from a number of factual witnesses. The first witness was Danny Farren who had been a Director of West 3 since 1998 and had dealt with commercial matters, including tendering and oversight of works. He said he attended site about once a month to carry out a valuation of the work. He gave evidence of the background to the Agreement and, in particular, what happened at the pre-order meeting on 20 October 2006 when Mizen informed him of the change of the gas supply system. He said that he was told that detailed drawings would be supplied but at the meeting Mizen produced a basic sketch which showed the new location of the gas meter room and provided him with some brief hand written notes which he cannot now find.
37. He explained that the principle was that the individual gas supplies were to go from the gas meter room, up the riser duct and then be distributed to each flat. He said that West 3 was under pressure to provide a revised price for this quickly.
38. He said that West 3 then produced a revised price on 24 October 2006. He then referred to a letter dated 25 October 2006 in which West 3 stated that its price had allowed for the supply of 1½ inch TracPipe for the gas supply. He set out prices for 1¼ inch and 1 inch TracPipe and asked Mizen to confirm with the consultants what size was suitable.
39. He said that, after being informed orally by Mizen that they wanted to proceed with the quotation based on the price for 1 inch TracPipe, he confirmed this in the e-mail of 3 November 2006.
40. He said that West 3 commenced work on 20 November 2006 and proceeded to carry out the gas mains distribution by installing 1 inch (28mm) TracPipe from the meter room in the basement of block A to the riser ducts in Blocks A and B and then to the individual flats, all using 28mm TracPipe.

41. In relation to further drawings being issued by Mizen, he said that West 3 had the Revision A version of drawings 100-120 issued with the tender invitation dated 24 August 2006. He also said that the drawing register issued by Mizen records that Revision A was issued again on 22 November 2006. He said that West 3 do not have Revisions B and C of those drawings which are recorded as being issued to West 3 on 13 December 2006. He said that as far as he can recall or discover West 3 never received the letter of 13 December 2006 or the accompanying drawings, either at their head office or on site. Nor, he said did West 3 receive the letter of 14 May 2007. He said that he had searched thoroughly for all documents, including drawings which related to this Project in West 3's possession and could not find them and, so far as he could tell, there did not appear to be any other significant documents missing. He said that he personally dealt with West 3's correspondence and files in 2006.
42. He accepted that West 3 did not build what was shown on drawings 100-120 Revision A in relation to gas risers. He said West 3 was asked to use the original tender issue drawings except for an amendment to the price to provide for TracPipe distribution from meters located in the gas meter room up to the individual flats. He referred to the sketch showing the position of the gas meter room and said it was explained to him that West 3 were to run TracPipe from the gas meter room to the risers and from there to the flats and they were asked to price for this. He said this was explained by the site team which included Andrew Mullins who was leading the negotiations and they were looking at the drawings while this was being explained. It was suggested to him that he could not build what he did without drawings but he said he followed the instructions at the pre-order meeting and what they had agreed in the Agreement.
43. He was then taken to later correspondence and, in particular, the letter from Mizen to West 3 of 1 December 2008 and asked why he did not respond to that to say that West 3 had carried out the works in accordance with the instruction. He said that West 3 did not respond until Mizen and the client had decided what they wanted to do in terms of remedial work.
44. He was asked whether it was strange for all the pipe to be the same size at 28mm. He said that West 3 gave the prices for the different sizes of pipe and did not choose the size themselves. He said he gave Mizen a cost on an "extra over" basis and asked Mizen to check with the consultants what size the pipes were to be. He was then taken to the drawings and said that West 3 installed what they had agreed to install. In relation to whether there was room in the riser ducts/holes in the floor for larger size pipes, he was shown a number of photographs of the riser ducts and it was suggested to him that further pipes could have been installed and if they had required a larger space it would have been for Mizen to solve the problem. He said that he had told Mizen that extra space was needed and said that West 3 were not responsible for the builders' work or penetrations.
45. In relation to the evidence in his statement that a significant part of the pipe work had been installed by 13 December 2006, he was shown an application for payment dated 6 December 2006 and he said that West 3 had completed the works in 24 flats which was about 25% of the 103 flats in the blocks. He said that this was the work which was completed but there was other work which had been carried out. In

respect of Mizen's case that West 3 had not installed the right size of pipes, he said that West 3 had put in what they had been instructed to install.

46. The next witness was Ian Jerrett who had formerly been employed by Mizen as a site manager for the Project but gave evidence on behalf of West 3. He said he was involved in the Project from February 2007 as a site manager. He explained that the difficulty with the pipes in the riser duct was when they came out of the duct at a floor level they had to be laid in single layers so that the screed could be laid over them. He accepted that on the Project Mizen carried out the work by commencing screeding in the flats and then moving towards the common areas. In his statement he said that the only drawings he had seen were the original drawings and not revised versions but he said he did not know whether he had seen the letter of 14 May 2007 and the attached drawings register. He said that Mike Walsh, the site manager, dealt with administration whilst he was on site. He said the problem of fitting the pipes into the duct was on block B first floor where there were a large number of gas pipes in the basement.
47. The next witness was Gavin Charlton, Mizen's construction operations director who had been employed by Mizen since 1 October 2008. He confirmed he had no personal knowledge before that date. He was referred to his letter 1 December 2008 and accepted that the reference to West 3 having tendered against revised drawings was not accurate. He also accepted that his reference to 25mm piping was based on the reference to 1 inch piping. In relation to the size of the risers he was referred to a meeting with the client held on 4 December 2008 where a technical solution to the low gas pressure was to increase the size of the pipe. In that document he had said that consideration needed to be given to whether the risers could be enlarged. He was also referred to a document which he had prepared at the end of 2009 in which proposals to overcome low gas pressure were considered. He was referred to a passage where he said the main consideration was one of capacity within the fixed service risers which limited the opportunities to increase the distribution pipework size. He said that, although he had written that it was the main consideration, it was one of a number of considerations. He said this was his view at the time but it changed when they opened up the work and he could see there was more space. He also said that he was advised that the hole in the riser duct slab could be increased in size by taking the 50mm concrete cover off the reinforcement.
48. He said that when he met Mr Farren in January 2010 his concern was the problem with the 1 mbar pressure and Mr Farren had said in response that West 3 had installed a single size pipe but did not say that this was what they were supposed to install.
49. Mr Ben Chapman then gave evidence. He left Mizen in November 2007 when the project was substantially complete and it came as a surprise in August 2013 when he was asked to give evidence. He said that he remembered a lot of what was happening on site as this was the largest flagship scheme he had worked on. In relation to the Agreement he accepted that it was a fixed-price lump sum contract and he took care to "pin" West 3 to a firm price. He accepted that there would be no more money payable to West 3 without a variation order under Clause 8.1 of the Contract.

50. He was taken to documents which showed that the client, Ujima Housing Association, had not wanted the gas meters to be located in the flats but in a separate gas meter room. He was taken to an email written by Mr Mullins on 28 September 2006 to the client about the location of the meters. Mr Mullins said that they had designed the services to use common supplies which then branched out to the individual flats which were metered in each flat to keep the riser size to a minimum. He said he asked Ujima how they wanted to proceed as the implications of running 103 individual gas and electric metered supplies from the basement to each apartment was considerable, particularly for the gas pipes. He said that there is a gas regulation requirement that there should be no more than 1mbar pressure drop from the meter to the appliance. He emphasised that any change would undoubtedly mean that they had to revisit flat layouts resulting from the increased riser sizing, in addition to locating gas and electricity meter rooms within the basement. Mr Chapman was aware that, at the time, Mizen was trying to persuade the client not to change. He said he was not aware of what was done to implement that requirement between the 28 September and 20 November 2006 but he was aware that Wilkins MacKenzie were instructed at some point to provide revised drawings.
51. He said that he was present at the meeting on 20 October 2006 and he accepted that Mr Farren was given the drawing of the gas meter room and told what was required by way of additional works. He accepted that Mr Farren knew where the gas meter room was and knew the route from the risers to the flats. He accepted that there was very little doubt as to what the route was and he accepted that West 3 wanted detailed drawings which were said to be coming.
52. In relation to West 3's letter of 25 October 2006 he said that he had asked for alternatives of 1¼ inch and 1 inch pipes because, with the lack of design, he needed a representative order value to include in the order. He was referred to a comment by West 3 that Mizen should confirm with the consultants what size pipe was suitable. He said that he did not know what he did in response but that Wilkins MacKenzie were to confirm the size of piping. He confirmed that when he received a revised price of £693,000 on 3 November 2006, he wrote to say that there were some additional works and also that Mizen "*would wish you to clarify the gas pipe material allowed within this cost.*" This then led to Mr Farren's email of 3 November 2006 in which he confirmed that they had allowed TracPipe up to 1 inch. He accepted that it was a conscious decision to proceed for the purpose of the value in the Contract on the basis of 1 inch TracPipe. He agreed that this was on the basis that a variation instruction or a drawing issue which varied the work would have to be by way of a variation instruction. He accepted that the revised drawings required larger than 28mm pipe work and that he was not expecting West 3 to put in larger pipes without payment. He said if there was a variation to a larger pipe size he would expect there to be agreement over the cost. He agreed that until West 3 received revised drawings the agreement was that they would install 1 inch TracPipe and that was the basis of the order. He said that if drawings were issued which showed a different pipe size and by then work had been carried out and screeded over, Mizen would have to engage a contractor to dig up the screed but he added that this issue never arose.
53. Mr Chapman confirmed that he had prepared the letter of 22 November 2006 and the drawing register. He was asked whether it was common to send out a copy of

drawings for construction at the beginning of the project and he said he would not personally do so. He said he thought that he had written revision A by mistake because he noted that he had received drawings 100-120 Revision B from Wilkins MacKenzie the previous day. He was taken to the Wilkins MacKenzie drawing register exhibited by Mr McKenzie which showed that other drawings in the 1000 series had also been issued by Wilkins MacKenzie on 21 November 2006 but were not noted on the drawing register as being sent on 22 November 2006. It was put to him that he did not know what was sent out on 22 November 2006 and he said that he only had what the documents showed.

54. In relation to the letter of 13 December 2006 he said originally that he had handed the letter and drawings to a person on site who was the plumbing foreman or representative of West 3. It was put to him that Mr Lake was not the person whom he described as being given the drawings. He said he would not ask the person on site to provide a signature. He was asked about the reference in the letter of 13 December 2006 to the drawings being issued “direct to your Site Supervisor” and said that the project manager would issue the drawings to the person in charge or he would do so. He was taken to his witness statement but accepted it was either him or the project manager who handed the documents over.
55. He agreed that if the drawings required a variation he would expect the sub-contractor to cost that variation and come back to him, but he did not recall any such response from West 3. Although he said that it was possible for West 3 to go ahead with the work and then deal with the cost later, he accepted that under clause 8.1 an agreement on scope and price had to be reached prior to execution.
56. He was asked about the letter of 10 November 2006 which was sent out with the sub-contract order. He said that his understanding was that whilst the original drawings identified were those issued on 24 August 2006 this was changed by the various documents referred to subsequently including the note of the pre-order meeting and the email confirming the size of the TracPipe as 1 inch.
57. Peter Mackenzie gave evidence. He was a principal director in Wilkins Mackenzie Associates Limited, the mechanical and electrical engineering design consultants engaged by Mizen in 2005 in relation to the Project. Mr Mackenzie was the lead design consultant between 2005 and 2008 and was responsible for producing all mechanical and electrical engineering designs for the project. He was also engaged between 2008 and 2012 to provide advice in relation to the rectification of defects on the Project. He said that an essential part of the design was the pipe sizing and that this was part of his responsibility although he would have expected West 3 as a CORGI installer to have been able to carry out the necessary calculations.
58. In relation to design calculations he agreed that the piping design document did not give design data for lengths of pipes greater than 70 metres, such as those installed on the Project but he said that the document describes in the text how to extrapolate for longer lengths.
59. He was asked about the note on drawing 101A which referred to the gas carcass running into flats “to terminate with 22mm gas isolating valve” and then “Gas carcass runs out to serve boiler and hob” and “Gas to boiler to rise and reduce to

15mm to connect to boiler.” He was also referred to drawing 100B where it said in relation to the Hob: “15mm gas point left capped off in cooker space” and in relation to the Combi boiler: “22mm gas carcass rises to boiler turns out and reduces to 15mm to connect to boiler.” He said that the intention was for the distribution to change from TracPipe to copper and be 22mm and then change to 15mm where it connected to the boiler and the hob. He said if there was any conflict between the requirements this should have been raised by West 3.

60. He said that on 28 September 2006 Ujima had commented on the Wilkins MacKenzie drawings and this had led to the proposal to use a gas meter room in the basement and distribution pipes to each of the 103 flats. The point raised by Mr Mullins was whether, with the increase in the number of pipes to 103 individual pipes, there would be enough space in the holes in the slab in the risers. He said it was the holes rather than the risers which gave concern. He was taken to an email of 13 March 2009 where he summarised the position in terms of chronology and said that on 28 September 2006 Wilkins MacKenzie issued sketch mark-ups showing the proposed gas meter room and subsequently on 4 October 2006 issued mark-ups for new holes required for the gas risers. He said he sized them by approximate sizes using 28mm or 32mm pipes and 15mm spacing. He said he believed Mizen carried out the work to provide the hole in the riser in block A but not in block B.
61. He recalled being instructed some time in 2006 to produce revised drawings which he sent out on 21 November 2006. He accepted that he had been chased for the details on 16 November 2006 and said he did his utmost to get the drawings to Mizen as soon as he could. He was asked about the method used for sizing the pipes and said he used the TracPipe 2005 design guide which was the same method as in BS6891 and the CORGI design guide. He said that the need to have less than 1 mbar pressure drop told you the length of pipe at a particular flow with a given size of pipe.
62. He said that until he sent out his revised drawings on 21 November 2006 Mizen did not know what size of pipe was going to be specified. When Mizen and West 3 were corresponding about the pipe sizes on 25 October 2006 he said it was not referred to him, as he recalled it.
63. He was then referred to his evidence that when he visited site he found that generally pipe shown on the drawings as being 32mm diameter had actually been installed in 28mm diameter and also that pipes which were shown as 28mm diameter had actually been installed as 22mm diameter. He was asked where the pipes which were supposed to be 28mm had been installed as 22mm. He said there were a small number of flats where there was 22mm instead of 28mm on the basis that overall there were only 17 where 28mm was specified. He said there were possibly considerably less than 17 but it could be a dozen. He said the fact that some were in 22mm meant that not all were in 28mm so someone in West 3 must have decided to put in 22mm. He said it was possible that it was done by mistake but it seemed like a calculated decision.
64. I formed the view that all the witnesses did their best to recall matters from 2006 to 2008 and evidently Mr Farren had a better memory and Mr Charlton only became involved at a later stage. Mr Chapman’s recollection was not good mainly because

he had been away from the Project for a long time and only became involved recently in this dispute.

65. I then heard expert evidence. West 3 called Andrew Durber of Blue Flame Associates. He had worked in the gas utilisation section of the industry for 30 years and was a Member of the Institution of Gas Engineers and Managers and chairman of a panel dealing with BS6891. Mizen called evidence from Mr Kenneth McDougall who is a chartered engineer and a Fellow of the Institution of Mechanical Engineers and of the Chartered Institution of Building Services Engineers. He said that he had experience in dealing with gas and other installations and in sizing pipes and had been involved in the installation and replacement of gas mains services for the London Borough of Camden.
66. Both experts were obviously well experienced but I felt that, on the issues in this case, Mr Durber's evidence demonstrated a clearer knowledge of the matters raised by those issues. It was unfortunate that Mr McDougall's calculations were shown to contain a number of errors but he did subsequently provide amended calculations. On some issues, such as the question of whether Wilkins MacKenzie's drawings were concept drawings or the role of West 3 under BS6891, I found Mr McDougall's views unpersuasive.
67. On the issue as to whether the designs contained in Wilkins MacKenzie's revised drawings were practically possible to implement, the experts agreed that the hole in the riser duct for the gas pipework to pass through would have had to be increased in size, based on the revised drawings. Mr Durber had produced a theoretical calculation of the cross-sectional area of the hole in the riser duct necessary at lower ground and ground floor slab levels for the 28mm gas pipes to pass through compared to the size of opening which would have been needed for the pipe sizes in the revised design. This showed the increased area which would have been required for the revised design.
68. Whilst Mr McDougall did not calculate the size of hole needed, he accepted that a much larger hole would be needed to put the pipes through and he pointed out that the change was from the original tendered design of two pipes to the revised drawings showing 103 individual pipes.
69. Both experts had carried out calculations to see whether, if West 3 should have installed larger size pipes and if it were possible to do so through the holes in the riser, the system would have delivered adequate gas pressures to all of the flats. The experts agreed that there were two methods, one was to use the TracPipe manual, BS6891 or the CORGI design guide but this was a coarser method. The second method was to go back to basic principles in pipe sizing and to make an adjustment for a buoyancy correction arising from difference in atmospheric pressure on a vertical riser.
70. Mr Durber had carried out calculations for flats 98, 99 and 41 first using the coarser method. That led to figures which showed that the pressure loss exceeded the design pressure loss criteria laid out in clause 5.2.2 of BS6891 which provides:

“The pressure drop between the outlets of the meter and the points to be connected shall not exceed 1mbar at maximum flow conditions.”

71. Mr Durber then carried out further calculations which he subsequently corrected which showed that for flat 98 the adjusted pressure loss was 0.66 mbar, for flat 99 it was 0.95 mbar, but it was 1.59 mbar for flat 41. He said that in relation to the figure of 0.95 in flat 99, on the basis of the need to allow for future extensions such as putting in a gas fired oven or a new boiler he would have increased the pipe size because it was so close to the 1m bar pressure loss. On this basis he concluded that the revised design would not have complied with the 1 mbar requirement in BS6891. He said that this was as far as he went and he had not looked at each individual flat to see whether there were others which did not comply with the 1 mbar requirement. Mr Durber’s second method was derived from IGE/UP/2 which, at Appendix 2, provides guidance on designing gas installation pipework from first principles. Mr McDougall had used the CIBSE Guide Book C, Table C4.46 which gave data on smooth copper pipes which TracPipe indicated should be used for pressure drop calculations for TracPipe calculations from first principles.
72. Mr Durber accepted that his first principles calculation depended very much on the diameter of the pipe as that factor was used in the formula to a power of five. He confirmed that the pipe size diameter was critical to the flow rate and the pressure drop. A calculation was then put to him which compared the pressure drop per metre which had been derived by Mr McDougall using the CIBSE table with the pressure drop per meter derived from IGE/UP/2, as used by Mr Durber. That comparison showed that where Mr McDougall had calculated a pressure drop per metre of 0.011, (as corrected during the hearing from 0.009), Mr Durber’s method would give a figure of 0.007. Equally where Mr McDougall had calculated a pressure drop per metre of 0.03, Mr Durber’s method would show a pressure drop of 0.02. This showed that Mr Durber’s method predicted a lower pressure drop than Mr McDougall’s method.
73. Mr Durber was asked about his allowance for bends, tees and valves and he said he had made allowance based on the figures which TracPipe had set out in their design document. He said he did not think that this over compensated for these fittings.
74. Mr McDougall accepted that the use of the first method based on the TracPipe table gave rise to difficulty when the pipe lengths were greater than those in the table. He accepted that where distances are greater than 50 metres it was not a simple task but he had done it and he said that both BS6891 and the CORGI guide had been designed for tradesmen to do to the simple calculation. In his view an installer could have designed the size of pipe. He was asked about the reference to BS6891 clause 5.1.1 which provides:

“At the initial stages of building design and planning the designer/installer shall verify that the installation pipes will be adequate for both immediate and probable future requirements.”

75. He was asked whether that only applied where “designer/installer” were the same person. He said he considered that the installer would have to give the relevant CORGI certification and, in any event, he considered that the drawings produced by Wilkins MacKenzie were concept drawings and that the detailed design should have been carried out by the installer. He accepted that, in the end, there would be tests on the installation and said that a test would be required to confirm the 1 mbar pressure drop. It was put to him that this would mean having to measure a pressure drop between the two ends of a pipe but he said that an inert gas could be used to carry out the test.
76. In relation to his calculations he had used a figure of 3.5 cubic metres per hour for the boiler but accepted that this should be 3.71 cubic metres per hour as set out in the boiler manufacturer’s data sheet. He was referred to his Appendix 2 where he had calculated pressure drops using the TracPipe design and installation guide 2005 and confirmed that the circuits to 13 flats might have had a pressure drop great than 1 mbar. He confirmed that all of these flats were flats where under the revised design the pipes were still specified at 28mm. He confirmed, though, that there had been no allowance in this for a buoyancy effect. In relation to his calculations using the second method, he was referred to his Appendix 3 and accepted that Note 2 was not correct. He was taken to paragraph 5.4.29 of his report where he derived the pressure drop for a 35mm pipe and accepted that he had multiplied by 0.9 instead of dividing by 0.9 so that his figure should have been 0.011 mbar/m instead of 0.009. He also accepted that in Note 5 his buoyancy adjustment should have been only two-thirds of what he had allowed.
77. The experts were able to agree that, for flat 41, the length of pipe before adjustment for any fittings was 62.1 metres. Mr Durber had calculated it at 66 metres and Mr McDougall had calculated at 57 metres after allowing for adjustments for fittings. Mr McDougall was asked about allowance for bends and elbows and said he did not consider the figures given by TracPipe were correct, in particular for the large radius bends in this case. He could not however say what allowance he had made in terms of bends, tees or other fittings in his calculations. In re-examination he was asked about the notes on drawings 100B and 101C and considered that on 101C there was an inconsistency.
78. I now turn to consider the issues.

What was West 3’s contractual obligation under the Agreement as regards the size of the gas pipework?

79. Mr Seb Oram who appeared on behalf of Mizen submitted that the core obligation under the Agreement was for West 3 to comply with the drawings. He referred to Clause 2 of the General Conditions which stated that West 3’s obligation was to “Undertake and construct the Sub-Contract Works in accordance with the Detailed Drawings” and paragraph 1 of the Scope of Works which states that “Full plumbing and heating designs have been prepared by our Mechanical and Electrical Engineers. These are to be strictly adhered to...”.

80. He submitted that prior to the Agreement being signed West 3 had been informed of the change to the gas installation design and the documents contained in the Agreement indicate that the Sub-Contract Works were to be carried out to the revised design. He referred to the incorporation into the Agreement of the notes of the pre-order meeting and, in particular, item 11 dealing with the changed position of the gas meters and the provision of TracPipe from the meters, up the risers and into the flats. He also said that both Mr Chapman and Mr Farren confirmed that Mr Farren was given a sketch and told what was required and was told that detailed drawings would be supplied.
81. On this basis he submitted that the scope of the Sub-Contract Works was as set out in the revised drawings which would be issued after the Agreement was signed. In relation to the reference to 1 inch TracPipe he submitted that this was only a pricing allowance and that Mr Chapman was only seeking a representative order value. He said that there was no contractual obligation to install 1 inch TracPipe where that was inconsistent with the revised drawings. He pointed out that the letter from West 3 of 25 October 2006, where Mizen were asked to confirm with the consultants that the pipe size was suitable, was not incorporated into the Agreement.
82. Mr Roger Bartlett who appeared on behalf of West 3 submitted that West 3's obligation under the agreement was to install 1 inch TracPipe. He submitted that the effect of the pre-order meeting (as recorded in the letter of 23 October 2006) and the exchange of emails on 3 November 2006 was that West 3's obligation in respect of the gas distribution pipe was to install 1 inch TracPipe. He said that it was clear that the Agreement was not, by then, to carry out the gas distribution pipework in accordance with the drawings originally issued on 24 August 2006.
83. In relation to Mizen's contention that the obligation was to install the gas distribution pipework in accordance with revised drawings he submitted that, in so far as it depends on an oral agreement entered into prior to the Agreement, it would be excluded by the entire agreement clause in the Agreement. He also said that the first time this was put forward was after service of Mr Chapman's witness statement but in his oral evidence he simply said that the revised drawings would be issued. Equally he submitted that it was an unlikely interpretation of the Agreement that the price had been agreed and yet the requirements of the revised drawings were not known. Similarly, he submitted that it was not possible to construe the references in the Agreement to compliance with drawings to be compliance with the revised drawings.
84. When West 3 tendered for the Sub-Contract Works they tendered to carry out the work contained in the drawings issued on 24 August 2006. That consisted only of the gas distribution pipework within each flat from the gas meter to the hob and boiler. At the pre-order meeting that changed. The requirement then became one to install TracPipe from the basement meter room, which was indicated on a sketch, up the riser ducts and into the flats where it would then link to the gas distribution pipework originally envisaged. This was made clear in the letter of 23 October 2006 at item 11, incorporated into the Agreement.
85. The scope of the gas distribution pipework on the drawings issued on 24 August 2006 was therefore changed to this scope. It needed further definition in terms of

size of pipe and price. Initially West 3 provided a price for 1½ inch pipe but the email exchange of 3 November 2006 which formed part of the Agreement confirmed that a pipe size of 1 inch was included in West 3's price of £693,000. That then became the scope of the work. Whilst Mr Chapman characterised the allowance of 1 inch TracPipe as being a "representative order value" the price was described as a "firm, fixed price lump sum" in the Agreement and the pipe size was clearly stated. There was nothing provisional about this.

86. As set out in the letter of 20 November 2006 West 3's contractual obligation was to carry out the Sub-Contract Works in accordance with the drawings issued on 24 August 2006 (Item 18) subject to the amendments made at the pre-order meeting on 20 October 2006 that TracPipe sub-mains were to be installed from the gas meter positions in the basement at the locations tabled at that meeting up the risers and into the flat distribution network (Item 10) and that the gas supply pipe was to be 1 inch TracPipe as stated in West 3's e-mail of 3 November 2006 (Item 6).
87. There was a suggestion that Mr Chapman's witness statement supported a case that there had been an oral agreement with Mr Farren that West 3 would work to the revised drawings when they arrived and that was part of the Agreement. I do not think the witness statement supports that and certainly that was not the effect of Mr Chapman's oral evidence. In any event, any prior oral agreement which was not incorporated into the agreement would fall foul of Clause 15 of the General Conditions which provided:

"Subject to the Special Conditions these General Conditions of Sub-Contract are the applicable terms and conditions of the Sub-Contract Agreement and are the entire agreement between the Contractor and the Sub-Contractor and no variation or amendment or the delivery of the Sub-Contractor's terms and conditions shall have effect unless expressly confirmed in writing by the Contractor. In the event of an inconsistency between the General Conditions and Special Conditions, the Special Conditions shall prevail."

88. In his closing submissions Mr Oram sought to say that the effect of the documents incorporated into the Agreement was to make West 3's obligation one to carry out the Sub-Contract Works in accordance with the revised drawings. That is not, in my judgment, a possible reading of the documents. The Agreement, both in the signed document and in the letter of 10 November 2006 incorporated into it, makes specific reference to the drawings issued on 24 August 2006. The documents of 23 October 2006 (item 11) and the exchange of emails on 3 November 2006 make it clear that the gas distribution pipework is not to be limited to that within the flats as shown on the original drawings but was to include the 1 inch TracPipe.
89. There is nothing in those documents to show that it changed the Sub-Contract Works to include whatever work was shown on the revised drawings when they were issued. Even if there had been something to indicate that this was a possible interpretation, which there is not, then it seems to me to be a wholly uncommercial

meaning to give this contract. Mizen was keen to have the fixed lump sum price and to know what pipe material was included in that price. For there to be an agreement that the price would cover whatever was in the revised drawings would have been very unlikely in any commercial agreement without very clear terms and certainly would not be the likely effect given the background in this case.

90. It follows that West 3's contractual obligation under the Agreement was to install 1 inch TracPipe as the gas distribution pipe from the gas meter room to the flats. West 3's obligation under the Agreement was that it would supply labour and material and associated plant. It had no design obligation in relation to the size of gas pipe or, in particular, as to whether gas pipe of that size was suitable to comply with the 1 mbar pressure drop requirement at para 5.2.2 of BS6891. West 3 had no obligation under the Agreement in terms of methods of installation of the gas piping or workmanship so as to deliver adequate gas pressures. That was a matter for the design of the gas distribution pipework which was not West 3's responsibility. Equally the obligation under Clause 5.1.1 of BS6891 did not fall upon West 3 as it was a matter of design. West 3's obligation was to adhere to the drawings prepared by Wilkins MacKenzie, as amended in relation to the TracPipe.
91. Therefore in relation to this issue, my answer is that West 3's contractual obligation under the Agreement as regards the size of the gas pipework was to install 1 inch TracPipe. Any question of the suitability of that size of pipe to meet the 1 mbar gas pressure drop requirement or otherwise was a matter for Mizen and its designers and not for West 3 who had no design responsibility. West 3's obligation was to carry out the Sub-Contract Works in accordance with the drawings issued on 24 August 2006 subject to the amendments made at the pre-order meeting on 20 October 2006.

Was the original contractual obligation ever effectively varied and, if so, what was the effect of any such variation?

92. Mr Oram submitted that if, contrary to his submissions on the first issue, the Sub-contract Works did not from the outset incorporate the revised drawings and the obligation to install 1 inch TracPipe overrode the drawings, then the issuing of the revised drawings had the effect of varying the Sub-Contract Works. He submitted that any requirement under Clause 8.1 of the general conditions, which were incorporated into the Agreement, was waived by Mizen as it was for the benefit of Mizen.
93. He submitted that the revised drawings were, in fact, received by West 3. He relied on the letter of 22 November 2006 but, principally on the letter of 13 December 2006. He submitted that Mr Chapman's evidence that he sent the revised drawings on 22 November 2006 should be accepted so that the drawing register was in error both as to the revision of the 100 series drawings and the absence of the 1000 series drawings. He said that the evidence shows that Wilkins MacKenzie issued the drawings on 21 November 2006 and Mr Chapman's evidence was that he would have issued those almost immediately to West 3 and would not just have issued another set of the original drawings.

94. Further, he submitted that in any event the court should accept Mr Chapman's evidence that he handed one copy to West 3's site supervisor, as confirmed in the letter of 13 December 2006. Further, he submitted that there is no proper evidence as to why the letter of 13 December 2006 should not have been received by West 3. He pointed out that the West 3 did not apparently receive the letter of 14 May 2007 and when the pressure drop defect became apparent, Mr Farren did not contest Mizen's statement that West 3's obligation was to install a gas distribution network "of varying sizes from 28mm diameter upwards". He submitted that there is a fundamental incredibility in West 3 not having received the revised drawings.
95. Mr Bartlett submitted that Mizen had not pleaded that there had been any variation under the Agreement and therefore there is no case on how or on what terms there has been a variation. In any event, he submitted that there was no evidence either that there was an instruction or that there was an agreement as required by Clause 8.1 of the general conditions.
96. In relation to the receipt of revised drawings, Mr Bartlett submitted that the court should find that the revised drawings were not provided to West 3. In relation to the letter of 22 November 2006, the evidence of the drawing register should be preferred to Mr Chapman's evidence of what he thought must have happened. He also submitted that the evidence that a copy of the revised drawings was issued on site on about 13 December 2006 should be rejected given the inconsistencies in Mr Chapman's recollection. Further whilst otherwise it might seem unlikely that the letter of 13 December 2006 was not received, that, he said, was consistent with the evidence that nothing appears to have happened after that date by reference to revised drawings. He pointed out that there was no discussion as to the necessary changes to work already carried out or as to the change in the prices to take account of the revisions in the size of the TracPipe.
97. I have come to the conclusion that, even if the revised drawings had been received by West 3, there was no variation of the Sub-Contract Works under the terms of Clause 8.1 of the general conditions. In my judgment, the terms of Clause 8.1 provide an exclusive way in which the Sub-Contract Works can be varied under the terms of the Agreement. It provides as follows:
- "The Sub-Contractor shall comply with any instruction issued by the Contractor whether to vary the Sub-Contract Works or otherwise. No variation to the Sub-Contract Works shall be effective unless agreed and set out in writing (both in terms of scope and value) and signed by an authorised representative of the Contractor before execution."*
98. Clause 8.1 therefore requires an instruction to be issued by Mizen. Whilst, in principle, a letter enclosing a drawing register and drawings might be sufficient to amount to an instruction, the second sentence limits the extent to which an instruction to vary the Sub-Contract Works takes effect. The scope and value have to be set out in writing and agreed and a document signed by Mizen before the varied work is executed.

99. In this case Mizen does not contend that there was a variation which complied with Clause 8.1. Rather it contends that the issuing of the revised drawings was sufficient. I do not accept that this is so, given the express and clear terms of Clause 8.1. Nor do I accept that Clause 8.1 is for the benefit of Mizen. It is a clause which makes sure that the scope and value of any variation is agreed in writing by both Mizen and West 3 before the work is executed. This is for the benefit of both parties. It benefits Mizen because it knows that West 3 will not be able to contend that other instructions which have not been the subject of the Clause 8.1 process are variations. Equally it benefits West 3 as it knows clearly what work is a variation because it must go through the Clause 8.1 process and it knows that the value must be agreed in advance so there is certainty as to payment. Whilst I accept that the requirement for the document to be signed by Mizen might be a matter which could be waived by Mizen if West 3 contended that there was otherwise a variation, that is not the position here.
100. As a result, whatever the position on the issue of the revised drawings by Mizen, I have come to the firm conclusion that there was no variation of the Sub-Contract Works from those I have set out above as forming the basis for the Agreement. It evidently did not form part of Mizen's pleaded case but in any event is not sustainable on the facts.
101. So far as the revised drawings are concerned, I find that they were not issued with Mr Chapman's letter of 22 November 2006. His evidence was, I consider, more an analysis of what he thinks might have happened in retrospect rather than his recollection of what did happen. However, the terms of the drawing register are clear and show that Mr Chapman was sending out a Contract ("C") issue of the relevant drawings and was not sending out the drawings either in the form of the revised 100 series drawings or the new 1000 series drawings which had been sent by Mr MacKenzie the previous day.
102. It is to be noted that there would have to have been two errors in the drawing register if MR Chapman had sent the drawings received from Wilkins MacKenzie. First, he noted Revision A instead of Revision B, which would be an obvious error and one which it would be difficult to make given that the previous column already showed Revision A as being issued. Equally, when the drawing register was issued again on 13 December and Revision B noted for the first time, if the drawings had previously been issued the error would have become apparent then and evidently did not. The second error would be that 1000 series drawings were issued on 22 November 2006 but not marked as being issued on the drawings register. Again that error would have become apparent on 13 December 2006 when they were first shown on the register.
103. As a result, I find that the drawing register issued with Mizen's letter of 22 November 2006 was accurate and that the revised drawings were not issued at that stage to West 3.
104. The position in relation to the letter of 13 December 2006 is not straightforward. The first question is whether a copy of the drawings was issued to West 3's supervisor on site. There is evidence that the drawings were issued because of what was said in Mr Chapman's letter of 13 December 2006. However although in his

witness statement he stated that he handed over the drawings and gave a description of the person to whom they were given, his oral evidence ended in confusion as to whether he had given the drawings himself to West 3's site supervisor or had left it to Mizen's site manager to do so. This considerably weakens the position from Mizen's point of view and if Mr Chapman did leave it for Mizen's site manager to issue the drawings then that would deprive the letter of 13 December of any force as Mr Chapman would be basing the statement in that letter on the fact that someone else had given them to West 3's site supervisor. It is to be noted that Mizen did not request a receipt for the drawings to be signed by West 3 which is often done in such circumstances.

105. The second question is whether a copy of the drawings was sent with the letter to West 3 at their head office. Mr Farren was the person responsible for such matters and says he did not recall receiving the letter. He said that he had checked the files and did not find the letter or drawings. If those drawings had been received I would have expected there to be some contact between Mizen and West 3 about them. Some installation work had already been carried out by 13 December 2006 and there would need to be some re-work. Nothing is mentioned about this. Equally, there would have to be some discussion about the change in the pipe size and the cost aspect given that a lump sum price had been agreed. There is no such correspondence and no evidence that anything like this happened.
106. There is some evidence to counter this in the fact that when problems arose and Mizen stated that West 3's obligation was to install TracPipe of 28mm (equivalent in this case to 1 inch pipe) and upwards, Mr Farren did not point out that this was not required. However Mr Charlton also stated in his letter to Mr Farren of 1 December 2008 that he was aware that "you adopted in your tender documents, a 25mm diameter distribution system." Mr Charlton accepted that the 25mm should have been 28mm but it indicates that the scope of what West 3 had tendered for was known to him. There is also the fact that the letter of 14 May 2007 and the attached drawing register and drawings does not appear to have been delivered. This seems surprising but equally might reflect a defective drawing issue system.
107. On balance I have come to the conclusion that, for whatever reason, the letter of 13 December 2006 with the attached drawing register and drawings was not issued to West 3 either on site or direct to the head office. The total absence of any reference to the amended drawings in the documents at the time is, I consider, persuasive evidence of non-receipt and counters any evidence which might otherwise suggest that the drawings were received.
108. I therefore find that the original contractual obligation was never varied. The revised drawings were not issued to West 3 with Mizen's letter of 22 November or the letter of 13 December 2006 or on site on about 13 December 2006. There was no variation of the Sub-Contract Works under Clause 8.1 of the general conditions nor by any other method.
109. This issue also includes a sub-issue of whether the designs contained in the revised drawings were practically possible to implement. There is evidence that at the time there was concern whether the additional size of TracPipe would have fitted in the riser ducts. In fact the issue is more whether the larger size of TracPipe could have

passed through the existing holes through the slabs in the riser ducts, particularly at the lower levels where a larger number of pipes would have had to have passed than on upper floors.

110. There is no doubt that, as Mr Durber helpfully illustrated, the plan area of the holes in the lower level of the riser ducts would have had to be increased to permit the larger size TracPipe to pass through. The photographs show that at the lowest level the existing TracPipe left little or no room for any increase in TracPipe size. However, whilst Mizen sought to convince Ujima of the problems of increasing the size of the TracPipe, that was in the context of a review of the necessity, in principle, for there to be 103 separate supply pipes going up the riser duct. There was evidence from Mr Charlton supported by the documents that the size of the holes could have been increased by taking away concrete cover which would have been one of the possible solutions which I consider would have led to the holes being increased and the problem being overcome had the increased size of TracPipe been installed.
111. I therefore conclude that the designs contained in the revised drawings were practically possible to implement.

Did the system as originally installed fail to deliver sufficient gas pressure to a substantial number of flats and would the system on the revised drawings have delivered adequate gas pressures to all the flats?

112. It is common ground that the system as originally installed using 28 mm TracPipe throughout failed to deliver sufficient gas pressure to a substantial number of flats. The main question is whether the system shown on the revised drawings would have delivered adequate gas pressures to all the flats.
113. This was an area where both Mr Durber and Mr McDougall carried out calculations. Mr Durber had revised his calculations in a corrigendum to his expert report. Mr McDougall's calculations, as stated above, were shown to have errors during his cross-examination but he submitted amended calculations after the hearing showing corrections.
114. As set out above the experts agreed that there were two methods, one was to use the TracPipe manual, BS6891 or the CORGI design guide but this was a coarser method. The second method was to go back to basic principles in pipe sizing and to make an adjustment for a buoyancy correction arising from difference in atmospheric pressure on a vertical riser.
115. On this basis, as finally corrected, Mr Durber analysed a small number of flats (41, 98, and 99) and came to the conclusion that the calculated pressure drop for Flat 98 would be 0.66 mbar, for Flat 99 would be 0.95 mbar and for Flat 41 would be 1.59 mbar. On this basis Flat 41 would fail to achieve the required limit of 1 mbar pressure drop. Mr McDougall carried out calculations for 103 flats and found that for all flats the 1 mbar pressure drop limit was achieved. In his revised calculation, he found a negative pressure drop for Flats 98 and 99, after making his allowance for buoyancy and for Flat 41 he found an adjusted pressure drop of 0.543 mbar. In relation to Flats 2, 7, 39, 44 all of which had 28mm TracPipe in the design shown

on the revised drawings he found pressure drops of 0.941, 0.941, 0.911 and 0.932 mbar respectively.

116. The difference between the experts in this case is best considered by referring to the analysis of Flat 41 where Mr Durber concludes the pressure drop is 1.59 mbar whilst Mr McDougall concludes that the figure is 0.543 mbar.
117. The relevant figures for the pressure drops from the meter to the valve in the flat are 1.12 mbar for Mr Durber and 0.858 mbar for Mr McDougall. From the valve in the flat to the boiler Mr Durber calculates the pressure drop as 0.8 mbar whilst Mr McDougall calculates it at 0.085 mbar.
118. Mr Oram submitted that, at most, Mr Durber's evidence was that one flat, Flat 41, would have failed the pressure drop limitation. He criticised Mr Durber's calculation for Flat 41 in having used 22mm TracPipe in the flats when that was not required in the revised drawings; in having used 5.24m³/h as the flow rate when 4.71m³/h was required; in overestimating the pressure drop caused by bends and joints and in using an assumption for the type of equivalent copper to be used for calculating pressure loss in a TracPipe.
119. Mr Bartlett submitted that Mr Durber's calculations should be preferred to Mr McDougall's calculations which were shown to be inaccurate in his evidence. Even if the court considered Mr McDougall's calculations as corrected after the hearing, there were still errors. Mr Bartlett referred to Mr McDougall's use of a 4.5m³/h as the overall flow rate when it should be 4.71m³/h and the use a flow rate of 3.5m³/h from the valve to the tee to the hob when it should be 4.71m³/h; his use of pipe lengths which are too short, as indicated from his initial calculation for Flat 41 and his failure to make a proper or certain allowance for bends of joints; his allowance for 28mm pipework in the flats when some would be 22mm or 15mm and his use of the CIBSE method.
120. I do not have the evidence to be able to assess precisely the effect of each of the points made in relation to each expert. However, in principle I consider that some reduction in Mr Durber's calculation of 1.12 mbar from meter to valve is needed to take account of the correct flow rate of 4.71m³/h although I am not persuaded that his assumption of an equivalent copper pipe is wrong. Even at the higher flow rate he calculates a pressure drop of 0.015mbar/m compared to the 0.013mbar/m calculated by Mr McDougall. Equally, within the flats some allowance for 28mm pipework is needed which would reduce Mr Durber's calculation of pressure drop of 0.8 mbar. Equally Mr McDougall's calculation should allow for the greater flow rates, the lengths should be longer and some allowance for 22mm and 15mm pipework should be allowed.
121. With those broad views on the calculations and taking account of the extent to which the points were put to the experts, I consider that Mr Durber's calculation can be taken as a starting point with some adjustments. Doing the best I can, if Mr Durber's calculation of pressure drop from meter to valve were to be adjusted so that it was 71.4 m length at a figure between 0.013 and 0.015mbar/m, say 0.014mbar/m, then his figure would reduce from 1.12 to about 1.0mbar. Allowing Mr McDougall's 0.03mbar/m for 28mm TracPipe from the valve to the tee to the

hob gives about 0.2mbar and allowing part of the rest as 28mm TracPipe would give, say, 0.3mbar from the tee to the boiler. This would give an overall pressure drop of 1.5mbar compared to the 1.96mbar figure used by Mr Durber. If an adjustment is made for buoyancy of 0.33 (Mr Durber) or 0.4 (Mr McDougall), then the calculation still indicates that the pressure drop is above 1.0mbar, albeit by a small margin.

122. My conclusion is therefore that on the evidence only Flat 41 has been shown, on balance, to be likely to have had a pressure drop of greater than but not significantly greater than 1.0mbar. There are concerns on the evidence that Flats 2, 7, 39, 44 and 99 would be close to the limit of 1.0mbar on the figures and might exceed 1.0mbar in practice. However, as explained in the evidence, whilst the limit in BS6981 is 1.0 mbar the acceptability of a pressure of, say, 1.1mbar would to some extent depend on the need for a given pressure at the hob and the boiler. I am not therefore in a position to say any more than that, on the evidence, on the balance of probabilities, the pressure drop in one flat, Flat 41, would be more than 1.0mbar.
123. In terms of answering the issue, I therefore conclude that the system as originally installed using 1 inch TracPipe would have failed to deliver sufficient gas pressure to a substantial number of flats and that the system on the revised drawings would not have delivered adequate gas pressures to all the flats because it would not, on balance, have met the required 1.0mbar pressure drop requirement in Flat 41 by a small margin.

Did the defect which caused the failure to deliver sufficient gas pressure result, wholly or partly, from West 3's breach of the terms of the Agreement?

124. As set out above West 3 installed a gas distribution network consisting of 1 inch TracPipe and this was in accordance with West 3's obligations under the terms of the Agreement. The defect which caused the failure of the gas distribution system to deliver sufficient gas pressure to a substantial number of flats was the fact that 1 inch TracPipe had been installed but that was in accordance with West 3's contractual obligation.
125. It follows from my conclusions that the gas pressure defect did not result, wholly or in part, from West 3's breach of the terms of the agreement.
126. There was some evidence that West 3 had installed 22mm instead of 28mm TracPipe but it was not clear what was the scope or extent to which this occurred. I consider that the evidence on this was inadequate for me to make any detailed findings as part of these issues.

Summary and Conclusion

127. Subject to any submissions on the precise wording of my conclusions, I would propose to make the following declarations:
- (1) West 3's contractual obligation under the Agreement as regards the size of the gas distribution pipework from the meters to the valve in the flats was to install 1 inch TracPipe.

- (2) Any question of the suitability of that size of pipe to meet the 1 mbar gas pressure drop requirement or otherwise was a matter for Mizen and its designers and not for West 3 who had no design responsibility.
- (3) West 3's obligation was to carry out the Sub-Contract Works in accordance with the drawings issued on 24 August 2006 subject to the amendments made at the pre-order meeting on 20 October 2006 and recorded in the documents incorporated into the Agreement.
- (4) West 3's original contractual obligation was never varied.
- (5) The revised drawings were not issued to West 3 with Mizen's letter of 22 November or the letter of 13 December 2006 or on site on about 13 December 2006.
- (6) There was no variation of the Sub-Contract Works under Clause 8.1 of the general conditions nor by any other method.
- (7) The designs contained in the revised drawings were practically possible to implement.
- (8) The gas distribution system as originally installed using 1 inch TracPipe would have failed to deliver sufficient gas pressure to a substantial number of flats.
- (9) The gas distribution system on the revised drawings would not have delivered adequate gas pressures to all the flats because it would not, on balance, have met the required 1.0mbar pressure drop requirement in Flat 41 by a small margin.
- (10) The defect which caused the failure of the gas distribution supply system to deliver sufficient gas pressure did not result, wholly or in part, from West 3's breach of the terms of the agreement.